RAZ

# FEMALE UROLOGY

SECOND EDITION

SHLOMO RAZ, M.D.

Professor of Surgery/Urology
University of California at Los Angeles School of Medicine
Los Angeles, California

# FEMALE UROLOGY

SECOND EDITION



W.B. SAUNDERS COMPANY
*A Division of Harcourt Brace & Company*

Philadelphia London Toronto Montreal Sydney Tokyo

W.B. SAUNDERS COMPANY
*A Division of*
*Harcourt Brace & Company*

The Curtis Center
pendence Square West
lelphia, Pennsylvania 19106

**Library of Congress Cataloging-in-Publication Data**

Female urology / [edited by] Shlomo Raz.—2nd ed.

p. cm.

Includes bibliographical references and index.

ISBN 0–7216–6723–6

1. Urogynecology. I. Raz, Shlomo.
[DNLM: 1. Genital Diseases, Female. 2. Urologic
Diseases. WJ 190 F329 1996] RG484.F46 1996
616.6′0082—dc20

DNLM/DLC 95–17714

Female Urology ISBN 0–7216–6723–6



in the United States of America.

Last digit is the print number: 9 8 7 6 5 4 3 2 1

# Foreword

*"An important scientific innovation rarely makes its way by gradually winning over the converting of its opponents: It rarely happens that Saul becomes Paul. What does happen is that its opponents gradually die out and that the growing generation is familiarized with the idea from the beginning."*

Max Planck, *The Philosophy of Physics*, 1936

When I began my training in surgery and urology in 1966 (and when I finished in 1972), the subject matter of female urology included urinary tract infection, the urethral syndrome, and a few retropubic or abdominal procedures to treat stress urinary incontinence and various fistulas. Even though we urologists regarded the treatment of all urinary incontinence as our divine right, the subjects of female pelvic anatomy, support, and prolapse were accorded little attention in our texts and literature. The female bladder was considered analogous to that of the male, and the area of the female bladder neck and urethra was generally described as a condensation of that of the male, minus the prostate. The "urethral syndrome" described virtually every combination of symptoms that emanated from the area between the umbilicus and the knees that was unassociated with cancer, culture-documented infection, and urinary incontinence. The uterus, fallopian tubes, and ovaries were "female organs" either that were a nuisance during surgery or that the gynecologists had already removed, and the vagina was a structure to surgically avoid, except during a few oncologic procedures.

For the current generation of graduating urologists, female urology has quite a different meaning. The concept properly includes the specialized anatomy, physiology, and pharmacology of the lower urinary tract in the female and all associated diseases and dysfunctions, and it includes the nononcologic and nonendocrinologic aspects of the female genital tract that are related to lower urinary tract function, its restoration, and its repair.

No one has been more instrumental in this fundamental shift of urologic thinking than the author/editor of this book, Shlomo Raz. As an individual whose first contributions to urologic science included prostatic receptor pharmacology (and the suggestion that alpha receptors might be useful to treat BPH-induced voiding dysfunction) and study of the effects of estrogen and progesterone on urinary tract smooth muscle, Dr. Raz was no stranger to innovation and to the scientific method. As a skilled scientist and surgeon who was frustrated with the state of urologic expertise in the realm of female lower urinary tract dysfunction and urinary incontinence, he has worked over the past 20 years to advance the knowledge of the pathophysiology, evaluation, and medical and surgical management of these problems, and to redefine the role of the urologist in addressing these areas. The first edition of his "bible," enunciating these principles, was planned in 1980 and published in 1983. Since that time, Dr. Raz has continued to expand the limits of female urology. There has been a continuing questioning of established "principles" and a steady progression of scholarly achievements in this area. Continuing to draw on his own expertise and experience, that of other independent pioneers in this field (Drs. Blaivas, McGuire, Tanagho, and others), and that of many of his former students (fellows), Dr. Raz has put together this second edition. Simply put, some broad strokes have been narrowed, the scope of female urology has been more precisely defined, and an all-inclusive text of principles, practice, and application has emerged. His philosophy of what this subject matter includes is now the rule, rather than the exception.

ALAN J. WEIN

# Contents

CHAPTER 7

# The Social Impact of Urinary Incontinence

Katherine F. Jeter, Ed.D., E.T., C.E.T.N.

The deleterious psychological, social, and economic sequelae of urinary incontinence have been widely considered and frequently reported in recent years.[1–15] However, it is difficult to draw conclusions from the literature because of disparate research methods, population samples, and definitions of incontinence. This chapter has several purposes. It begins with a brief review of prevalence and psychosocial impact studies. Findings from two extensive surveys of people with incontinence will be described, and, finally, suggestions for improving current clinical practices in the management of incontinent women will be discussed.

## Prevalence and Psychosocial Impact Studies

Incontinence of some degree affects many women in all age groups. In various studies in this country and abroad the prevalence of incontinence in women has been estimated to be between 9 and 74%.[3, 8, 15–19] Currently, the Clinical Practice Guideline on Urinary Incontinence in Adults, published by the Agency for Health Care Policy and Research (AHCPR) of the U.S. Public Health Service, estimates that 10 million Americans are affected by incontinence.[15] The majority are women. The Guideline panel acknowledges that this estimate may be low. The number of incontinent people in the United States could be twice that if one considers the actual number of women who are incontinent but have never told anyone, the number of those who still leak after incontinence operations or begin leaking again several years after surgery, and the limitations of previous prevalence studies.

Despite the fact that urinary incontinence is estimated to affect up to 74% of the female population, there are relatively few studies that measure the social impact of urinary incontinence on the daily lives of women.[20] These studies, like prevalence studies, use varying definitions of incontinence and varying scales and tools to measure impact. It seems obvious that attitudes toward voiding dysfunction vary widely among individuals and in different age groups, but research to verify this has been limited.[21] Wyman and colleagues summarized the results of 19 studies in 1990.[20] In these and other studies, avoidance of specific activities was a recurrent finding.[6, 10, 18, 22, 23] Decreased outings from home, less participation in social activities, and avoidance of sexual intimacy were frequently reported. Despite a decade that has seen an enormous increase in the amount of attention given to the prevalence, incidence, and impact of incontinence by the scientific community, governmental agencies, and the media, women with this condition in 1995 may not be receiving the treatment that they need or desire.[24, 25]

## The Problem of Defining Incontinence

The concept of incontinence still eludes definition. Currently, there are three commonly used definitions, and numerous others are used occasionally. The International Continence Society (ICS) defines incontinence as ". . . involuntary loss of urine which is a social or hygienic problem and which is objectively demonstrable."[26] The Clinical Practice Guideline on Urinary Incontinence in Adults eschewed the ICS definition in favor of ". . . the involuntary loss of urine which is sufficient to be a problem."[15] In publications targeted to lay people, the

definition may be different from these. A common explanation of incontinence is "the unexpected loss of urine in any amount, on a regular basis, in an inconvenient place. . . ."[1, 27] Because previous studies have not shown a correlation between the amount or frequency of urine loss and emotional distress, still other definitions might be considered, such as, "Incontinence is the inability to go to the bathroom when you want to and where you want to." Recognizing that loss of bladder control may not be a problem to patients with dementia, but that it is a leading cause of admission to nursing homes when families find it too taxing to care for an incontinent relative, another accurate definition might be, "Urinary incontinence refers to the uncontrolled passage of urine."

## Social Influences That Affect Attitudes and Bladder Habits in Different Age Groups

The cause of incontinence in women remains unclear, but in most cases it is multifactorial.[19, 28] In the past efforts have been made to discover a psychogenic component.[2, 4, 29–36] Although several studies have shown that neuroticism and psychological factors may coexist with incontinence, there probably is not a cause-and-effect relationship.[2, 4, 29, 35] However, a reduction in sensory urgency and urine leakage has been shown to reduce psychological symptoms and improve the quality of life.[2, 37–38] Practically speaking, elimination of the "fear of accidents" and the comfort and confidence of being able to toilet predictably every 2 to 3 hours rather than unpredictably every 30 minutes to $1\frac{1}{2}$ hours certainly enhance psychological well-being and facilitate the opportunity to participate in social activities. Although it is doubtful that urinary incontinence in women has psychogenic origins, there are nevertheless psychological and social influences that exert a powerful impact on attitudes toward toileting and toward loss of bladder control.

### CHILDHOOD AND ADOLESCENCE

Bowel and bladder control are highly prized in early childhood because they connote maturity, intelligence, and discipline. Children with nocturnal enuresis usually will not sleep at friends' homes or go away to camp because of the fear of ostracism or taunting. During adolescence, girls report an unwillingness to use the toilets at school because there are no doors on the stalls to give them privacy during urination. Schools explain that they must be able to maintain surveillance for drug use and cigarette smoking in the bathrooms. There is often inadequate time for girls to use the toilet between classes. Students report being reprimanded when their use of the bathroom between classes causes them to be late for the next class. School officials say they cannot allow pupils unrestricted access to bathrooms between and during classes because this would be disruptive, and most students would abuse the privilege. It is not uncommon for middle school and high school girls to void only before and after school. Such common practices do not tend to engender healthy attitudes toward elimination or reasonable bladder habits in adulthood.

### ADULTHOOD

In adult women there are environmental and occupational impediments to good bladder habits. Although several states have introduced "potty parity" laws to increase the number of women's toilets in public places, it is not unusual to see long lines in ladies' restrooms at cultural and sporting events, airports, and meeting sites where the audience is predominantly female. Some women report restricting the amount and types of fluids they consume in anticipation of particular activities. Some employers restrict access to toilets. Assembly line workers, stenographers, and teachers may be required to urinate by the job's schedule rather than by their bladder capacity. Even without published policy guidelines governing toilet use, nurses, waitresses, and secretaries may find it difficult to urinate at reasonable intervals. Symptoms of sensory urgency, frequency, and incontinence may preclude a woman from taking or keeping certain jobs. A recent tongue-in-cheek article in a popular women's magazine describes the inadequacy of women's restrooms in office and government buildings and asserts that "the American economy is not going to appreciate the importance of a decent restroom to the average female worker until the American economy is run by women."[39] In fact, until recently in the U.S. Capitol, female senators have had to wait in line with tourists downstairs from the Senate chamber for want of access to a closer toilet because those outside the Senate chamber used to be for men only.

### LATER LIFE

In the ever-increasing elderly population there are myriad social influences on bladder habits and serious repercussions for women who become incontinent or whose continence is marginal. Many public facilities and churches do not have accessible bathrooms. A woman with precarious bladder control or irritable voiding symptoms will soon determine "safe environments" in which she can get to the bathroom quickly. Consciously or subconsciously, she will eliminate places and programs where toileting would be difficult. Buses and vans that transport senior citizens to social functions and medical appointments usually do not have toilets. Older women report being unable to take advantage of transportation services because of this. Incontinence is not just a leading cause of admission to nursing homes; it may affect

the living arrangements of tens of thousands of other older women. In the burgeoning retirement community industry, in which there are usually three levels of care—independent living, personal care, and skilled care—loss of bladder or bowel control usually results in a resident being moved from an independent living arrangement to a unit that provides more personal services. This loss of independence with enforced and increased professional assistance is a demeaning and expensive consequence of urinary incontinence.

## How Women Have Reported the Experience of Incontinence in the Decade from 1983–1993

In 1983, a year after Help for Incontinent People (HIP),* a national nonprofit advocacy organization, was founded, the popular advice columnist "Dear Abby" discussed incontinence and advised her readers to write HIP for more information. Nearly 50,000 people wrote for help. They complained of embarrassment, loneliness, isolation, and frustration with the medical profession. In 1986 HIP developed a six-page, 34-item questionnaire, which was mailed to 33,500 people. Completed surveys were returned by 10,427 individuals.[10] The majority were reasonably healthy women 60 years of age or older who were living at home. The average length of time they had been incontinent was 9 years. Many of their management or coping strategies were self-devised. Modifying drinking habits and toileting practices were the two methods most commonly used to control urine loss. Feminine hygiene products and paper towels were the products most often used. Incontinence was described as a major problem with important social implications by 17.3% of them. This is consistent with the findings of a number of investigators.[38, 40, 41] However, the fact that *most* women say that they are not severely burdened by incontinence does not mean that *all* patients should not be carefully assessed to determine the impact of incontinence on their health and quality of life.[19, 28, 42, 43] Several worrisome findings appeared in the 1986 HIP survey. Nearly 40% of respondents believed that they were incontinent because they were old; another 20% said that they did not know why they were incontinent. These misconceptions may account for some women's failure to report incontinence to a physician or to articulate their symptoms during an office visit. The medical profession received poor marks from this sample population. Half of the respondents described doctors or nurses as not helpful or too busy; 37.5% did not think that the health care provider was informative or knowledgeable. Nearly one-fourth (24.4%) thought that the doctor was embarrassed or unsympathetic. Only 9.7% said they were helped very much by their doctor, and 56.5% reported that their treatment was "no help at all." Findings from this survey cannot be generalized because the population represented a unique group. The majority of those surveyed were readers of an advice column and recipients of a quarterly newsletter about incontinence. However, the survey gave valuable insight into the lived experience of women with incontinence.

In 1992 a similar survey was sent to 115,000 people.[25] Half of them were members of HIP, and half had made one request for information from the organization but had not had sustained contact. Analyses of 3986 (4%) completed surveys were tabulated. Again the survey population was predominantly healthy older women living in the community. Some attitudes and behaviors had changed noticeably since the 1986 survey. More than 86% of the women had seen a physician about their incontinence. This is a marked increase from previous studies, which reported that only 25 to 50% of women had consulted a physician.[10, 14, 18, 24] As in the earlier HIP survey, incontinence was perceived quite differently within the group. Women whose incontinence was characterized by urgency and frequency were most likely to consider it a major problem. Dissatisfaction with the medical profession was high but not as high as in the earlier survey. More people became worse (6%) with treatment than were improved by it (3.2%). Women who elected to have surgery had both the highest levels of success and the highest levels of treatment failure. This finding is consistent with that of Diokno and associates in a study of 51 women in which it was reported that only 39% of those who had undergone surgery to correct urine loss had achieved absolute continence during a median follow-up period of 12 years.[44] Diokno and his colleagues also found that urologic symptoms were reported more frequently by respondents who had had surgery than by nonoperated respondents, suggesting that symptoms may have been induced by the operation. HIP's 1992 survey supported this finding, although it was impossible to determine whether the bothersome symptoms of frequency and urgency were caused by the operation or simply became more noticeable after symptoms of stress incontinence had been alleviated. Respondents to HIP's 1992 survey were asked to rate their bladder control problems on a scale of 1 to 5, with 5 being the greatest and 1 being the least of their concerns. Embarrassment was ranked highest, and odor was ranked second. Isolation from friends and family was the least worrisome to the respondents (Table 7–1). These data refute earlier reports that isolation from friends and family is common among incontinent people and may reflect an attitudinal change resulting from a decade of public education and perhaps improved management options.[11, 15] In their daily lives, 55% of respondents termed their

*Help for Incontinent People is a not-for-profit organization dedicated to improving the quality of life of people with incontinence. HIP is a leading source of education, advocacy, and support to the public and the health professions about the causes, prevention, diagnosis, treatments, and management alternatives for incontinence. For additional information, write HIP, P.O. Box 8306, Spartanburg, South Carolina 29305.

TABLE 7-1
**Rating of Bladder Control Problems**

| Types of Worry | Numerical Rating | Mean Score All Respondents |
|---|---|---|
| Embarrassment | 5 = Greatest worry | 3.4 |
| Odor | 4 | 3.0 |
| Cost | 3 | 2.6 |
| Isolation—friends | 2 | 2.3 |
| Isolation—family | 1 = Least worry | 2.0 |

loss of bladder control "always bothersome but manageable." Only 13.5% described it as a major problem, and 26% described it as an occasional nuisance. More than twice as many respondents in 1992 had been taught to do Kegel exercises than had been taught in the earlier population. Ideally, this change indicates a shift toward behavioral interventions for women with mild to moderate stress and urge incontinence.

## The Difficulty of Measuring the Social Impact of Incontinence

Evaluating the social impact of incontinence requires scrutiny of both the social milieu and the cultural and historical attitudes of patients and health care providers. Early definitions of incontinence refer to it as an inability to suppress sexual appetite.[5] By 1976, English dictionaries added urine and fecal loss to the earlier definition, but incontinence was still defined primarily in terms of sexual promiscuity and bad temper. Thus, the term incontinence bespeaks lack of restraint and control and is a value-laden term. Furthermore, the time, place, and method of urination are culturally proscribed. The age of expected continence and toilet training and the point at which incontinence is no longer tolerated vary between cultures, within cultures, and between generations. In the 1950s and 1960s in the United States, early toilet training was the mode. Children in most states, even as late as the 1970s, were not allowed to attend public schools until they had achieved continence. Social attitudes and laws have changed remarkably in the past three to four decades. In the 1990s young parents are less likely to attempt toilet training as early as their parents did. They are less likely to be punitive toward preschoolers who have not achieved bladder control. Incontinent children, by virtue of legislation ensuring that all children have equal access to education in the least restrictive environment, now are ensured entry into public schools. The popular press, however, continues to refer to the subject of incontinence as "a closet issue" and the "last taboo," reinforcing the social stigma that continues to be associated with lack of bladder control.

## Relating the Social Implications of Urinary Incontinence to Clinical Practice

To interpret the social implications of incontinence in women and apply them to current clinical practices to improve care for women with this pervasive condition, the *lived* experience of urine leakage must be separated from the *fact* of urine loss.[45] The fact and the lived experience may be quite dissimilar within groups, and it certainly varies between age groups.[18, 45] Urine leakage during intercourse in a 25-year-old newly married female cannot be equated with urine leakage in a 19-year-old paraplegic in her work setting, an 84-year-old woman who wants to travel with a church group, and a severely cognitively impaired 78-year-old nursing home resident. However, despite individual differences, varying urinary symptoms, and changing social morés, incontinent women currently share several unique burdens:

1. They do not report the onset of incontinence promptly and may "put up with it" for 6 to 9 years before seeking medical treatment.[7, 10, 18, 38, 42]
2. Women are accustomed to using feminine hygiene products and choose them in many instances instead of products specifically designed for urine absorption.[10, 18]
3. When they do seek treatment, women are likely to have their incontinence symptoms dismissed and to be dissatisfied with the results of their treatment. When their symptoms cannot be verified objectively by pad tests or urodynamic methods, they may be referred for psychological counseling or labeled neurotic.[36]
4. Despite mounting evidence that behavioral interventions promise improvement and even cure in many women with voiding dysfunction and urinary incontinence, American women are seldom offered this therapy.[25, 28, 38, 46, 47, 48]

### DIAGNOSIS

The reasons why women tolerate incontinence for many years before seeking medical care remain unclear. Bayliss and Norton and associates found embarrassment to be the major factor causing delay.[38, 42] Both of these study populations were English, and the majority (79%) of general practitioners in England are men. Because embarrassment is acutely felt among incontinent American women and 81.9% of physicians in the United States are men, this factor may explain the similar delay in seeking treatment among American women. Norton and associates found that elderly women waited twice as long to seek treatment as younger women because they feared that surgery would be required. Other studies indicate that many women think that urine leakage is normal and not a condition that warrants medical treatment.[38] Others believe it to be, or are told that

it is, an expected part of getting old. It is possible that some women do not deem their incontinence troublesome enough to spend the money or time needed for medical care. This latter attitude merits future research. These various attitudes have important implications for health providers.

A sensitive approach to the subject of urine leakage is required while taking a woman's history and performing the physical examination. It is helpful to send history forms and voiding diaries to the patient prior to the initial office visit. These imply that incontinence is common and may put patients at ease with the subject. It may also help them describe their urinary history better when they are given adequate time to think about it and spared the embarrassment of having to describe it in a face-to-face encounter with a health professional of the opposite sex. A prescreening intake or incontinence history might best be taken by another woman. Patients may be more comfortable with an office or clinic nurse, a physical therapist, or even a medical social worker whom they perceive to be an ally who would be less critical or scornful of this embarrassing condition.

Continuing public information and patient education are essential to cause women to recognize incontinence as a treatable symptom and to seek solutions for it aggressively. Consumers need to be taught how to access a health provider with a special interest in the diagnosis and treatment of incontinence and to request a second opinion if their primary physician does not take the complaint seriously or dismisses it as part of being female or as an expected complaint of aging.

## TREATMENT

Once urinary incontinence has been identified as a symptom, the cause and the impact of the symptom on the patient's quality of life merit equal attention. Symptoms that are not secondary to anatomic displacement, concomitant medical conditions, or pharmacologic therapy required by another illness can be minimized or eliminated completely by modifying toileting behavior, daily activities, diet, and lifestyle.[48] The patient's active participation is required. Women are most likely to become involved and be compliant and to achieve success with treatment if their bladder symptoms interfere with social, intimate, or occupational activities *and* when a therapeutic relationship is developed between the caregiver and the patient.[20, 37, 41] Psychotherapy has been shown to improve bladder symptoms even in the absence of cystometric changes.[35] Might the sympathetic and proactive attitude of a physician or nurse be equally therapeutic? Various types of behavioral interventions have been shown to be effective in reducing incontinence in women.[25, 28, 38, 46, 49] Although cost comparison data are not yet available, it seems obvious that two to six sessions with a patient conducted by a nurse or licensed allied health professional to teach toileting procedures, describe dietary influences on bladder habits, teach pelvic muscle exercises, monitor progress, and reinforce desired outcomes would be less expensive than medication or surgery.[35, 48, 49, 50] Other obvious advantages are that many of these interventions might have an additive effect with pharmacologic therapy or surgery. Rosenzweig and colleagues attempted to evaluate psychological status before and after surgery for stress incontinence.[36] They concluded that women who continued to experience urinary symptoms and psychological distress after surgery that had been deemed to be curative by urodynamic measures should be considered for psychological evaluation. Perhaps these women could have benefited from a therapeutic relationship with a health care provider who could help them improve their bladder habits with behavioral therapy. Experiences in programs that offer *only* behavioral therapy suggest that patients are not as frustrated when behavioral therapy yields only partial success as they are when expensive medications or surgical procedures do not result in complete resolution of symptoms.[37, 38, 49]

A caveat to urologists and gynecologists is that they must be enthusiastic proponents of behavioral interventions as first-line therapy. This offers assurance to their patients that the initiation of behavioral treatment rather than drugs or surgery does not imply that their symptoms are unimportant or "not bad enough for medicine or surgery."

Because symptoms of frequency and urgency are so troubling to patients, bladder training to increase the intervals between toileting coupled with dietary modification to minimize irritative voiding symptoms should improve patients' psychological well-being.[25, 28, 35, 37, 48] Several factors have been identified as impediments to the success of behavioral interventions: duration of incontinence, poor compliance, and obesity.[2, 28] Addressing each of these issues with patients and assisting them with printed materials, record-keeping forms, and personnel to monitor and reward success as well as encouraging a weight control program may improve treatment outcomes. Reaching women in health clubs, beauty salons, and health education forums who are just beginning to have problems with incontinence may be the key to improving the success of behavioral therapies. Bavendam and colleagues, in a study of women who used weighted vaginal cones, found that those women who referred themselves for cone use had the most successful outcome.[51] In a recent survey o women who completed a 4-hour educational program about the causes, treatments, and management al ternatives for or pertaining to urinary incontinence 24 of 40 women who completed the course were inter viewed. One participant (5.8%) was cured; 47% rate their improvement as 20 to 90% better; two (11.6% elected to have surgery, and one patient (5.8%) rate her incontinence as worse after the class. Fiv women (29%) had no change in their symptoms bu also had made no change in their daily activities o bladder habits.[49] All women expressed satisfactio with the program and said they would recommend

to a friend. The cost to the hospital to conduct the classes, including simple refreshments, was $34.00 per person. Such classes warrant investigation, refinement, and pilot programs to investigate their efficacy.

### DEFINING AND PREPARING HEALTH PROFESSIONALS

Family physicians and internists should be encouraged to include a sensitive and thorough continence evaluation in their routine patient assessments.[8, 19, 43] Nurse practitioners, nurse specialists, and some physical therapists practice in settings where an incontinence evaluation would be appropriate. With some advanced training, these health professionals should be able to evaluate patients' voiding dysfunction and recognize those for whom behavioral intervention would be appropriate and those for whom referral to a specialist would be preferable. Women admitted to the hospital for other conditions should have a thorough continence evaluation.

All health workers, school administrators, employers, and lawmakers should be educated to view bladder health and bladder control as a woman's right. Every effort should be made to construct enough toilet facilities, to provide adequate time for toileting, and to offer sufficient privacy and respect to encourage females to understand the importance of developing good bladder habits.

## Implications for Future Research

Regardless of the difficulties inherent in defining the social impact of urinary incontinence on the lives of women of all ages, it is obvious that loss of bladder control results in restricted activities and other physical and social limitations. However, fewer than 20% of women describe incontinence as a major problem. There is no explanation for why women tolerate incontinence for an average of 7 to 9 years before seeking treatment. Are they resigned to their "female lot"?[52] Have they felt rebuffed by a health professional? Are they unaware that treatments are available that may improve or cure their symptoms? Do they fear that the cure would be worse than the disease? Why are tens of thousands of women calling nonprofit advocacy organizations and government agency numbers for help? Why are so many women dissatisfied with their medical treatment and the care they receive? What accounts for the difference between a study conducted by medical researchers, which showed that consumers believe that physicians could help them with their incontinence even after surgery has failed, and studies conducted by nonmedical groups, in which women perceived physicians as "not helpful"?[10, 25, 44, 52]

Prospective studies to identify strategies that maintain continence and prevent incontinence are urgently needed. Efforts must be continued to destigmatize incontinence and to develop more reasonable attitudes toward bladder function and dysfunction in different age groups. Now that behavioral interventions have proved effective, future research should be directed toward comparing the relative effects of different treatments and identifying factors associated with treatment failure.[5] Rather than continuing to select study subjects by age or symptoms, it is time to change the focus to determine how the lived experience of incontinence varies during the life span and how treatment choices—surgical, pharmacologic, and behavioral—affect the quality of life. It is not difficult to teach allied health professionals to recognize urinary symptoms that warrant referral to a urologist or urogynecologist for management, but it may be a significant challenge to teach surgeons to recognize patients for whom behavioral intervention would be most therapeutic and to refer these women to an individual qualified to provide this care.

Rather than separating subjective complaints of incontinence from objective demonstration of bladder leakage in a laboratory, self-reporting of bladder dysfunction and its effect on daily activities must be considered reliable data and treatment outcomes should be measured according to patient expectation and patient satisfaction. In most studies the social impact of incontinence varies widely and does not correlate with the amount of leakage or the duration of symptoms. Thus, in the majority of cases, the first-line intervention for women with urinary incontinence should be education to prepare them to choose the therapy that they believe will offer the most benefit in the context of their social setting. Surgery, in the absence of physical abnormalities that threaten renal function or cause debilitating symptoms, should be presented as an elective procedure.

### REFERENCES


1. Gartley CB: Managing Incontinence. Ottawa, IL, Jameson Books, 1985, p 11.
2. Oldenburg B, Millard RJ: Predictors of longterm outcome following a bladder retraining program. J Psychosom Res 30(6):691–698, 1986.
3. Mohide EA: The prevalence and scope of urinary incontinence. Clin Geriatr Med 2(4):639–654, 1986.
4. Morrison M, Morrison LM, McAlister A, Glen ES: Visual analog scores and urinary incontinence. Br Med J 295:854, 1987.
5. Smith PS, Smith LJ: Continence and Incontinence. London, Croom Helm, 1987, p 27.
6. Breakwell SL, Walker SN: Differences in physical health, social interaction, and personal adjustment between continent and incontinent homebound aged women. J Community Health Nurs 5(1):19–31, 1988.
7. U.S. National Institutes of Health: Urinary Incontinence in Adults: Consensus conference. JAMA 261:2685–2690, 1989.
8. Jolleys JV: Reported prevalence of urinary incontinence in a general practice. BMJ 296:1300–1302, 1988.
9. Teasdale TA, Taffet GE, Luchi RJ, et al: Urinary incontinence in a community-residing elderly population. J Am Geriatr Soc 36(7):600–606, 1988.
10. Jeter KF, Wagner DB: Incontinence in the American home: A survey of 36,500 people. J Am Geriatr Soc 38(3):379–383, 1990.

11. Mitteness LS: Knowledge and beliefs about urinary incontinence in adulthood and old age. J Am Geriatr Soc 38(3):374–378, 1990.
12. Wyman JF, Fantl JA: Bladder training in ambulatory care management of urinary incontinence. Urol Nurs 11(3):11–17, 1991.
13. Sommer P, Bauer T, Nielsen KK, et al: Voiding patterns and prevalence of incontinence in women. Br J Urol 66:12–15, 1990.
14. Thiede HA: Prevalence of pelvic floor dysfunction in women. Conference on Pelvic Floor Dysfunction—An Initiative for Curriculum Enhancement in Residency Education. Chicago, The American Board of Obstetrics and Gynecology, 1992.
15. Urinary Incontinence Guideline Panel: Urinary Incontinence in Adults—Clinical Practice Guideline. AHCPR Publ 92-0038. Rockville, MD, U.S. Public Health Service, Agency for Health Care Policy and Research, 1992.
16. Versi E: Incontinence in the climacteric. Clin Obstet Gynecol 33(2):392–398, 1990.
17. Herzog AR, Fultz NH: Prevalence and incidence of urinary incontinence in community-dwelling populations. J Am Geriatr Soc 38(3):273–281, 1990.
18. Burgio KL, Matthews KA, Engel BT: Prevalence, incidence and correlates of urinary incontinence in healthy, middle-aged women. J Urol 146:1255–1259, 1991.
19. O'Connell HE, MacGregor RJ, Russell JM: Female urinary incontinence management in healthy, middle-aged women. Med J Aust 157(8):537–544, 1992.
20. Wyman JF, Harkins SW, Fantl JA: Psychosocial impact of urinary incontinence in the community-dwelling population. J Am Geriatr Soc 38(3):282–288, 1990.
21. Hunskaar S, Vinsnes A: The quality of life in women with urinary incontinence as measured by the sickness impact profile. J Am Geriatr Soc 39:378–382, 1991.
22. Norton PA: Prevalence and social impact of urinary incontinence in women. Clin Obstet Gynecol 33(2):295–297, 1990.
23. Lam GW, Foldspang A, Elving LB, Mommsen S: Social contacts, social abstention, and problem recognition correlated with adult female urinary incontinence. Danish Med Bull 39(6):565–570, 1992.
24. Norton PA: Non-surgical management. Conference on Pelvic Floor Dysfunction: An Initiative for Curriculum Enhancement in Residency Education. Chicago, The American Board of Obstetrics and Gynecology, 1992, pp 35–37.
25. Jeter KF, Verdell LL: Consumer focus '93: A survey of community-dwelling incontinent people. Union, SC, Help for Incontinent People, 1993.
26. Abrams P, Blaivas JG, Stanton SL, Andersen JT: The standardization of terminology of lower urinary tract dysfunction. Scand J Urol Nephrol Suppl 114:5–19, 1988.
27. Chalker R, Whitmore KE. Overcoming Bladder Disorders. New York, Harper-Collins, 1990, p 62.
28. Woodruff J, Thomas S: Behavioral medicine and the treatment of urinary symptoms. American Uro-Gynecologic Society Q Rep 11(1):1–5, 1993.
29. Norton KR, Bhat AV, Stanton SL: Psychiatric aspects of urinary incontinence in women attending an outpatient urodynamic clinic. BMJ 301(6746):271–272, 1990.
30. Hafner RJ, Stanton SL, Guy J: A psychiatric study of women with urgency and urge incontinence. Br J Urol 49:211–214, 1977.
31. Frewen WK: An objective assessment of the unstable bladder of psychosomatic origin. Br J Urol 50:246–249, 1978.
32. Stone CB, Judd GE: Psychogenic aspects of urinary incontinence in women. Clin Obstet Gynecol 21(3):807–815, 1978.
33. Crisp A, Sutherst J: Psychological factors in women with urinary incontinence. Proceedings of the International Continence Society and Urodynamic Society 1:174–176, 1983.
34. Morrison LM, Eadie AS, McAlister A, et al: Personality testing in 226 patients with urinary incontinence. Br J Urol 58:387–389, 1986.
35. Macaulay AJ, Stern RS, Holmes DM, Stanton SL: Micturition and the mind: Psychological factors in the etiology and treatment of urinary symptoms in women. BMJ 294:540–543, 1987.
36. Rosenzweig BA, Hirschke D, Thomas S, et al: Stress incontinence in women, psychological status before and after treatment. J Reprod Med 36(12):835–838, 1991.
37. Fantl JA, Wyman JF, McClish DK, et al: Efficacy of bladder training in older women with urinary incontinence. JAMA 265(5):609–613, 1991.
38. Bayliss V: Female incontinence: "The Basingstroke project." J R Soc Health 6:207–208, 1988.
39. Collins G: Potty politics: The gender gap. Working Woman, March 1993, p 93.
40. Lagro-Janssen ALM, Debruyne FMJ, Van Weel C: Psychologic aspects of female urinary incontinence in general practice. Br J Urol 70:499–502, 1992.
41. Wyman JF, Harkins SW, Choi SC, et al: Psycho-social impact of urinary incontinence in women. Obstet Gynecol 70(3):378–381, 1987.
42. Norton PA, MacDonald LD, Sedgwick PM, Stanton SL: The stress and delay associated with urinary incontinence, frequency, and urgency in women. BMJ 297:1187–1189, 1988.
43. Ouslander JG: Urinary incontinence: Out of the closet. JAMA 261(18):2695–2696, 1989.
44. Diokno AC, Brown MB, Brock BM, et al: Prevalence and outcome of surgery for female incontinence. Urology 33(4):285–290, 1989.
45. Klemm LW, Creason NS: Self-care practices of women with urinary incontinence—a preliminary study. Health Care Women Int 12:199–209, 1991.
46. Jeter K: Pelvic muscle exercises with and without biofeedback for the treatment of urinary incontinence. Probl Urol 5(1):72–83, 1991.
47. Newman DK, Smith DA: Pelvic muscle re-education as a nursing treatment for incontinence. Urol Nurs 12(1):9–15, 1992.
48. Bavendam TG: Geriatric female incontinence. Probl Urol 5(1):42–71, 1991.
49. Jeter KF, Tintle TE: Behavioral therapy in a group setting to promote continence in women: A test of efficacy and economy. Research Poster, American Urological Association Allied 25th Annual Meeting, San Antonio, Texas, May 16–20, 1993.
50. Forneret E, Leach GE: Cost-effective treatment of female stress urinary incontinence: Modified Pereyra bladder neck suspension. Urology 25:365–367, 1985.
51. Bavendam TG, Kallhoff JM, Gibbs CJ: Feminine vaginal cones for the treatment of stress urinary incontinence. Poster American Uro-Gynecologic Society 13th Annual Meeting, Boston, Massachusetts, August 27–30, 1992.
52. Glew J: A woman's lot? Nursing Times, April 9, 1986, pp 69–71.

# Slings

CHAPTER 31

## Abdominal Fascial Slings

Edward J. McGuire, M.D.
E. Ann Gormley, M.D.

### Historical Perspective

Goebell is credited with performing and describing the first pubovaginal sling in 1910.[1] Initially slings were fashioned from muscle including the pyramidalis, gracilis, levator ani, rectus, and bulbocavernosus muscles.[2] Price described the first fascial sling in 1933.[3] He used a strip of fascia lata, passing the fascia beneath the urethra from a suprapubic approach and fixing the ends of the sling to the rectus muscles. In the 1940s Millen, a urologist, and Aldridge, a gynecologist, described the creation of slings using paired strips of rectus fascia. Millen looped the strips under the urethra and then tied them together over the top of the urethra, whereas Aldridge sutured the strips together underneath the urethra.[2,4] Aldridge noted that one of the advantages of the procedure the way he did it was automatic compression of the urethra when the rectus muscle contracted during coughing or staining.[2] Now, some 50 years later, the current generation of pubovaginal slings uses this same mechanical advantage to correct urethral dysfunction associated with poor resting closure of the primary proximal sphincter mechanism, a problem that is not adequately addressed by standard suspension operations.

### Patient Evaluation

Patients who complain of urinary leakage associated with a change in abdominal pressure such as that associated with coughing, lifting, exercise, and laughing are considered to have a sign of stress urinary incontinence. The diagnosis of stress urinary incontinence rests on the determination that urethral urinary leakage exists in association with an increase in abdominal pressure. How much abdominal pressure is required to cause leakage is also an important part of the assessment of stress incontinence. A normal urethra will not leak at any abdominal pressure, whereas a urethra that moves will leak at a relatively high abdominal pressure, and a poorly closed proximal (intrinsic) urethral sphincter will leak at a low abdominal pressure. The fact that abdominal pressure does not normally cause leakage has been attributed to the function of the external sphincter, but for a number of excellent reasons that cannot be the case. Among these reasons is the observation that individuals in whom function of the external sphincter is absent do not develop stress incontinence.[5]

The diagnosis and quantification of stress incontinence are best done with videourodynamic evaluation. The filling behavior of the bladder is measured, and the ability of the urethra to resist abdominal pressure in the upright position is determined. The minimal pressure required to cause leakage is measured. The technique for determining the amount of abdominal pressure needed to cause leakage is described in another chapter, but the degree of intrinsic sphincteric dysfunction is inversely proportional to the amount of abdominal pressure required to cause leakage. That is, the lower the pressure of leakage, the worse the urethral function. Low-pressure leakage (<60 cm $H_2O$) is associated with some degree of intrinsic sphincteric dysfunction as opposed to a loss of the normal urethral supporting mechanism. Incontinence associated with intrinsic sphincteric dysfunction has been called type III stress

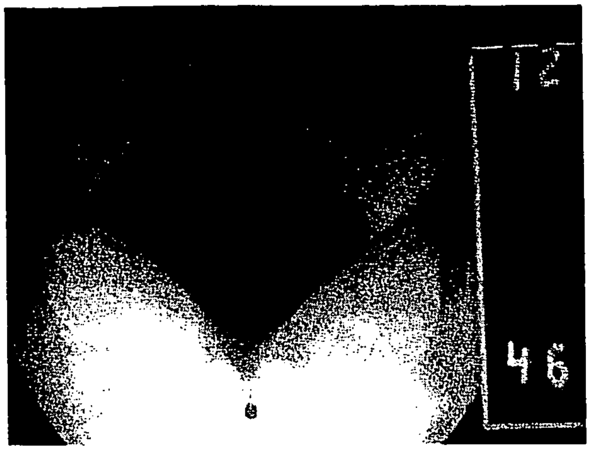



**Figure 31-1** A video urodynamic snapshot of a patient with type III incontinence. Note the low abdominal leak point pressure (12 cm $H_2O$), the open bladder neck, and the dysfunctional proximal urethra.

incontinence (Fig. 31–1). When higher abdominal pressures (>90 cm $H_2O$) are required to drive urine across the urethral sphincter mechanism, a situation that is typically associated with some degree of urethral hypermobility and displacement, the condition has been called type I or II stress incontinence.[6] If urethral resistance is very low, leakage may occur during filling, and bladder urine storage function may appear to be good when it is in fact poor. When urethral resistance is low and the abdominal pressure needed to cause leakage is also low, a Foley catheter with the balloon inflated and pulled down to occlude the bladder neck may be required to assess accurately the ability of the bladder to store urine at low pressures.[7] Urethral pressure profiles have no role in the evaluation of the patient with stress urinary incontinence. Urethral pressure profiles concentrate on the maximum urethral closing pressure, an area of the urethra that has very little to do with the ability of the urethra to resist abdominal pressure. However, maximum urethral pressure measurement is necessary to fulfill the diagnostic criteria for genuine stress incontinence according to the definition of the International Continence Society (ICS). Genuine stress incontinence is defined by the ICS as "the involuntary loss of urine occurring when, in the absence of a detrusor contraction, the intravesical pressure exceeds the maximum urethral pressure."[8] Simplified, it states that genuine stress incontinence is urine loss that occurs when abdominal pressure (intravesical minus detrusor) exceeds maximum urethral pressure. However, leakage driven by abdominal pressure has no relationship to maximum urethral closing pressure (Fig. 31–2). A poorly closed proximal urethral sphincter can and does leak at abdominal pressures lower than maximum urethral pressure. An additional difficulty with the ICS definition is that subtracted detrusor pressure (intravesical pressure minus abdominal pressure) must be calculated to ensure that a bladder contraction has not occurred. This requires a rectal catheter and a bladder catheter. Furthermore, it does not emphasize that abdominal pressure, not bladder pressure, is the most important measurement. We measure abdominal pressure only because it is the expulsive force in stress incontinence. We measure it in the bladder, but it is not detrusor pressure that we are measuring. Bladder activity is monitored fluoroscopically, and a diagnosis of stress urinary incontinence is not made if a bladder contraction is observed.

A pelvic examination is performed in the supine and upright positions to search for a cystocele, rectocele, enterocele, or uterine prolapse. These conditions, when identified, should be repaired when the sling is made.

## Patient Selection

Traditionally, slings have been used for patients with intrinsic sphincteric dysfunction. Most patients with low-pressure leakage from the urethra, indicative of intrinsic sphincteric dysfunction, have already failed to respond to one or more operations for stress incontinence.[9, 10] Many of these patients report that the prior procedure not only did not help their incon-

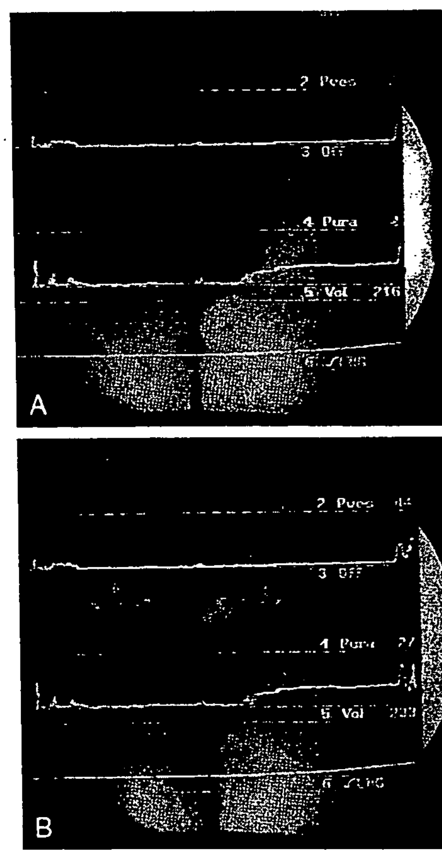



**Figure 31-2** Lack of relationship between the abdominal pressure needed to cause leakage and the maximum urethral pressure. *A*, Leakage occurs when abdominal pressure is lower than maximum urethral pressure. *B*, Leakage occurs when abdominal pressure is greater than maximum urethral pressure.

tinence but appeared to make it worse. Intrinsic sphincteric weakness associated with prior operative failure has been attributed to urethral and periurethral scarring and fibrosis, but this has never been documented pathologically. Intrinsic sphincter dysfunction may also be neural in origin, as in individuals with myelodysplasia, sacral agenesis, and $T_{12}$ spinal cord injury. In these conditions usually proximal urethral sphincter closing function is lost, but external sphincter function is preserved. Low abdominal pressure leakage is also seen in 9 to 10% of patients presenting with stress incontinence who have never had an operation for that condition and who do not suffer from neural disease.[11] In addition to patients who have a defect in proximal urethral sphincter function there are some special circumstances that favor the use of a sling because of the strength and durability of that procedure. Among these relative indications are extreme obesity, extreme physical activity such as gymnastics, chronic pulmonary conditions, especially severe asthma or progressive chronic obstructive pulmonary disease. Slings may also be used to effect complete closure of a damaged or nonfunctional urethra in combination with augmentation cystoplasty and construction of an abdominal neourethra or an ileovesicostomy.

A sling is a suitable procedure for patients of any age provided that the patient or caregiver can provide intermittent catheterization should that be required. The procedure has been used in patients ranging in age from 2 to 83 years.

A potential candidate for this procedure must have reasonable bladder storage ability (compliance). Compliance in patients with bladder decentralization or other neurogenic conditions can be adversely affected by the sling. Although that is unusual, it is better to be as certain as possible preoperatively that the bladder stores a reasonable volume at low pressure. A sling is not an effective barrier to bladder pressure as an expulsive force, and leakage driven by bladder pressure will recur at progressively lower bladder volumes after the sling procedure. In patients in whom poor compliance coexists with poor urethral resistance, a sling must be combined with some treatment that either reduces bladder pressure or enlarges bladder capacity.

The relationship between an unstable detrusor, urge incontinence, and stress incontinence is complex. These are not, however, mutually exclusive processes. Indeed, some 30% of patients with videourodynamically identified stress incontinence have both urge incontinence and a demonstrated contraction of the bladder on filling cystometrogram (CMG).[10, 12] Another 20 to 30% of women with stress incontinence diagnosed by a videourodynamic technique also complain of urge incontinence. In this group the filling CMG does not show a contraction. However, if this latter group is subjected to continuous monitoring of bladder pressure, a reflex bladder contraction is very often identified as the cause of the urge incontinence.[13] In addition, some patients evaluated by urodynamic study who have no symptoms of urge incontinence do demonstrate a bladder contraction on a filling CMG. Thus, the CMG is not a method of establishing or confirming the diagnosis of "urge incontinence." A patient with objectively established stress incontinence and a normal CMG is not necessarily a better operative candidate than a patient with stress and urge incontinence with or without a positive CMG.

Seventy percent of patients with both stress and urge incontinence experience relief from both conditions by an operation that cures the stress incontinence.[12] To complicate matters further, about 2 to 6% of all patients undergoing any operation for stress incontinence develop early, usually transient, de novo urge incontinence.[14] In the 20 to 30% of patients with persistent urge incontinence after surgery and in those who develop the problem de novo, treatment with drugs or occasionally operative methods may be required. However, nonoperative treatment of urge incontinence associated with severe stress incontinence is almost never effective and is probably not worthwhile. In other words, women with low abdominal pressure leakage of urine and urge incontinence will not benefit from anticholinergic therapy in lieu of surgery or injection therapy.

## Detrusor Function and Stress Incontinence Surgery

Patients with significant residual urine volumes preoperatively, not attributable to a cystocele, are not likely to be able to empty their bladder after a sling procedure. Patients who void habitually by straining will not be able to void in that manner after the procedure because the sling raises the abdominal leak point pressure to infinity (Fig. 31–3). The difficulty here is that some women with severe stress incontinence never void by contracting the bladder.

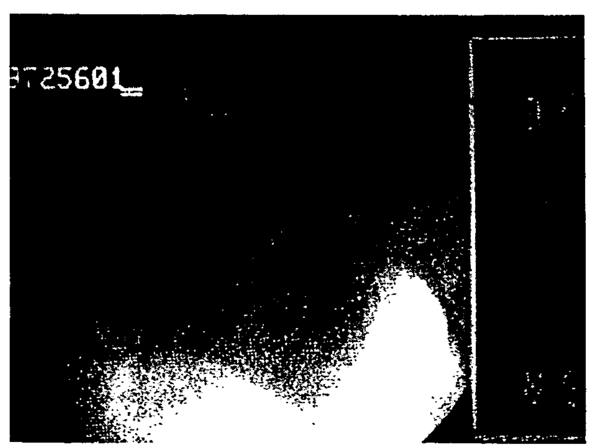


**Figure 31-3** A video urodynamic snapshot of a patient following a pubovaginal sling procedure. There is no evidence of leak at an abdominal pressure of 95 cm $H_2O$, which is the maximum pressure that this patient was able to attain.

After the procedure some of these women may be able to relearn how to void by a contracting the bladder, but it is impossible to predict this on an individual basis.[9] Further complicating the assessment of detrusor function is the fact that many patients who normally do void by a detrusor contraction fail to develop one in the urodynamic testing situation. Thus, even a crude assessment of detrusor power and strength, which requires a bladder contraction, often cannot be done. It is, however, quite reasonable to use a sling for patients with poor or absent detrusor contractile function provided that the patient can perform intermittent catheterization and is willing to do it indefinitely.

## Difficult Cases

A patulous urethra surrounded by dense fibrotic tissue may not be completely closed by a sling that provides only a vector force against the back of the urethra. There is a risk that the tension necessary to close such a urethra could result in obstruction or erosion. In some of these cases the sling will prevent stress incontinence. That function of the sling is visible on videourodynamic images, in which the urethra can be seen to be driven into the sling by an increase in abdominal pressure and securely closed. Unfortunately, when the patient is relaxed, even minimal motion, as for example when bending forward, can produce urinary leakage. In these cases, once the urethra is partly closed and immobile as a result of the sling, injection of collagen produces excellent results.

Patients with very wide patulous urethras associated with tissue loss, which may occur following a long period of treatment by an indwelling catheter with a large balloon, may be better served by a formal urethral closure and construction of a continent abdominal stoma or an ileovesicostomy.[10]

## Preoperative Care

Patients are told that intermittent catheterization will be required and must be mastered prior to discharge. If there is any question about a patient's ability to perform intermittent catheterization, he or she is taught the technique preoperatively. Patients are told that there is a small risk of permanent urinary retention and a possibility of lifelong catheterization. A clear urinalysis or a sterile urine culture is required prior to surgery. Patients are admitted after the procedure. They receive perioperative parenteral antibiotics 1 hour prior to the procedure.

## Procedure

The basic sling procedure has undergone many modifications since the description by Lytton and McGuire in 1978.[9] At present a combined abdominal and vaginal approach is used. The procedure takes about 40 minutes if two surgical teams are available. Patients are placed in the dorsal lithotomy position with the feet supported by Allen stirrups. An 18 Fr Foley catheter is placed, and the balloon is overfilled with 10 ml of water. A weighted vaginal speculum is placed in the vagina, and an Allis clamp is used to elevate the anterior vaginal wall, which is then infiltrated with normal saline to aid in the dissection (Fig. 31–4). A midline incision about 4 to 5 cm long is made from the area of the midurethra to the bladder neck. The vaginal wall is sharply dissected off the underlying periurethral fascia, which is visible as a glistening white surface. Identification of the periurethral fascia prevents inadvertent entry into a bad plane and bleeding associated with that event as well as inadvertent entry into the bladder during the dissection. The vaginal wall is dissected laterally toward the ischium. The pubocervical fascia is perforated sharply on each side to the urethra, gaining entry into the retropubic space (Fig. 31–5). Perforation of the pubocervical fascia and subsequent blunt dissection frees the attachment of the vagina from the tendinous arch and allows free motion of the urethra and the fascial envelope that contains it. Finger dissection is used to create a tunnel for the sling into the retropubic space toward the rectus muscle bellies.

A transverse suprapubic incision is made and carried down to the rectus fascia, which is opened in the direction of the skin incision (Fig. 31–6). The fascia is lifted off the rectus muscle bellies, and a strip of fascia measuring 1.5 × 4 to 8 cm is taken from either the upper or the lower leaf. The ends of the sling are sutured with several bites of 0 polypropylene suture to trap all of the fibers of the sling. The suture is tied down on the sling, and the needle is removed, leaving the sutures as long as possible. The suprapubic oper-

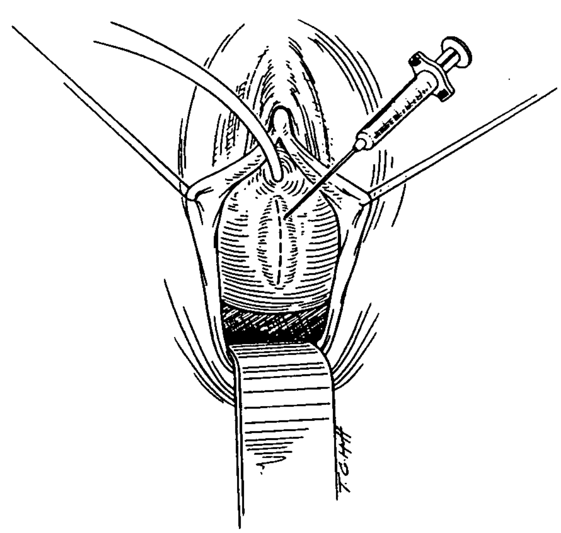


**Figure 31–4** The anterior vaginal wall is infiltrated with normal saline to facilitate dissection. (From Hurt WG [ed]: Urogynecologic Surgery. New York, Raven Press, 1992.)

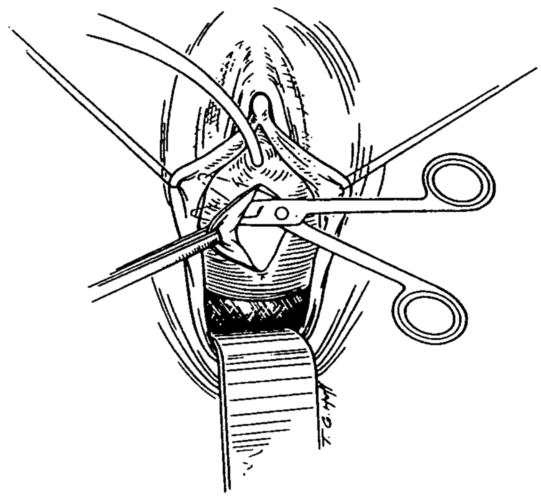


**Figure 31-5** The retropubic space is entered from below by perforating the pubocervical fascia. (From Hurt WG [ed]: Urogynecologic Surgery. New York, Raven Press, 1992.)

ator then retracts the lateral border of the rectus muscle just above the insertion into the symphysis toward the midline. A triangular area that will permit easy access to the retropubic space is visualized in an area where no previous operative scarring has occurred. Retropubic tunnels are developed in continuity with the previous vaginal dissection. A Crawford clamp is passed from above downward, taking care to keep the nose of the clamp in constant contact with the posterior surface of the symphysis (Fig. 31–7).

If an inadvertent injury to the bladder does occur it will be located at the upper lateral aspect of the anterior bladder wall. Bladder injuries should be suspected if blood is seen when the Foley catheter is irrigated with saline. If this occurs, the interior of the bladder must be inspected with a cystoscope and a new sling tunnel constructed. It is best to irrigate the bladder and perform subsequent cystoscopy if necessary with the Crawford clamp in situ. Visual-

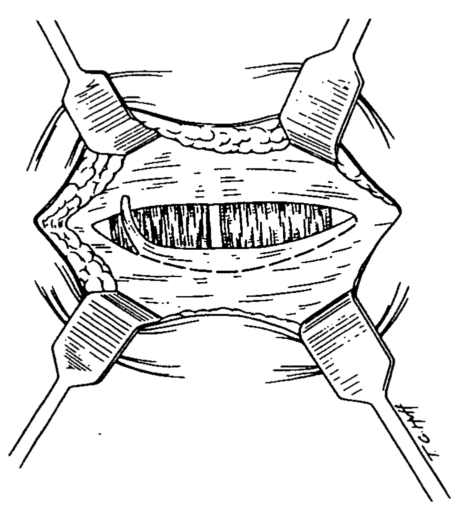


**Figure 31-6** A strip of rectus fascia is obtained through a suprapubic incision. (From Hurt WG [ed]: Urogynecologic Surgery. New York, Raven Press, 1992.)

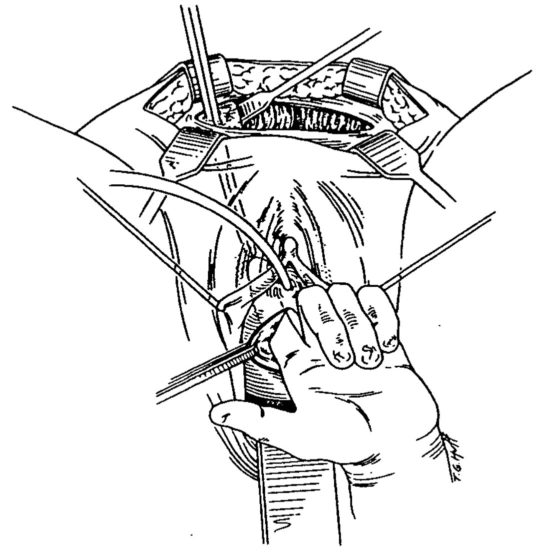


**Figure 31-7** A Crawford clamp is passed through the retropubic tunnel. Bimanual palpation is used, and the clamp is kept in contact with the symphysis. (From Hurt WG [ed]: Urogynecologic Surgery. New York, Raven Press, 1992.)

ization of a clamp in the bladder is very dramatic, whereas it is possible to miss seeing a piece of suture peeking through a small hole. If the bladder is entered it is drained for a period of 5 to 7 days rather than the standard 2 days.

The sutures on each end of the sling are grasped in the Crawford clamp, and the sling is gently pulled into the retropubic space bilaterally (Fig. 31–8). This seats the sling at the bladder neck in the correct position. The sling will ultimately arrive at the right position because the entry points into the retropubic space are just at the bladder neck and proximal urethra. The sling can move neither upward toward the trigone nor downward toward the external meatus. At this point, the sling is sutured to the periurethral

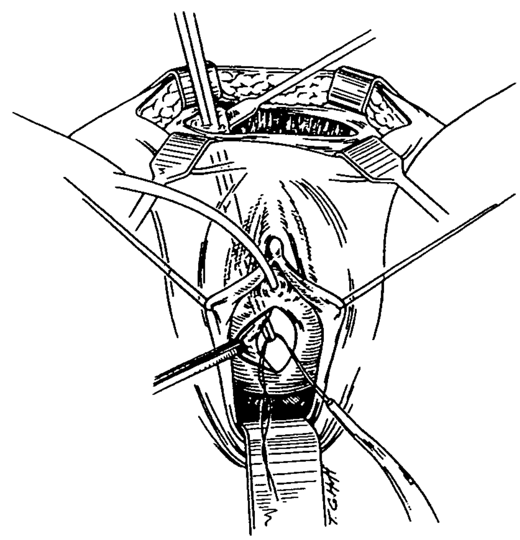


**Figure 31-8** The sling suture is grasped and the sling is pulled up into the retropubic tunnel. (From Hurt WG [ed]: Urogynecologic Surgery. New York, Raven Press, 1992.)

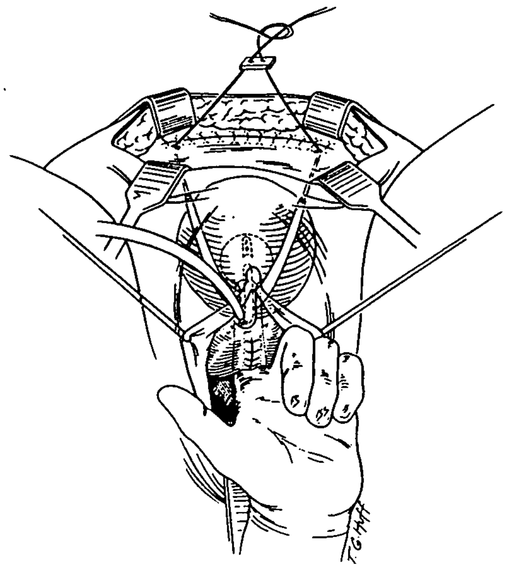


**Figure 31-9** The sling tension is assessed by palpation. The sling is then tied over a pledget. (From Hurt WG [ed]: Urogynecologic Surgery. New York, Raven Press, 1992.)

fascia to prevent dislocation and to spread the bearing surface of the fascia on the urethra as widely as possible. This is done with a 3–0 Vicryl or similar suture. The sutures at each end of the sling are brought through two small defects in the inferior leaf of the rectus fascia. The abdominal fascia is closed with 0 polypropylene, and the vaginal wound is closed with 3–0 chromic or similar suture.

The sling tension is adjusted so that gentle traction on the Foley catheter does not result in inferior and posterior urethral mobility (Fig. 31–9). The sling is secured by tying the two sutures over a Teflon pledget. It is better to tie the sling loosely rather than tightly. There is no useful way to measure sling tension intraoperatively that has prognostic value in terms of either achieving continence or preventing long-term use of intermittent catheterization. Previously we applied tension to the sling in an effort to increase urethral pressure beneath the sling by 6 to 10 cm.[9] This method required considerable time and turned out to have no predictive value. Others have described filling the bladder with fluid and then adjusting sling tension so that compression of the full bladder does not result in leakage. This is considerable overkill because a sling does not have to impede the expulsive force of bladder pressure. The purpose of a sling is to oppose abdominal pressure, and that can be achieved by a sling that barely closes the urethra. Coaptation may be assessed endoscopically; however, this ensures neither absence of incontinence nor freedom from retention. The subcutaneous tissues and skin are closed, and the vaginal vault is packed.

## Postoperative Care

The vaginal pack is removed on the first postoperative day. Patients are encouraged to walk. As soon as the patient is mobile and reasonably comfortable the Foley catheter is removed, usually on the second postoperative day. When the catheter is removed patients are encouraged to attempt to void frequently. They are told not to strain to void; if they cannot void they are to call the nurse for catheterization. Nurses are asked to catheterize patients at least every 4 hours and more often if requested by the patient. As soon as intermittent catheterization is begun the nurses begin the process of teaching intermittent catheterization to the patient. When patients can perform intermittent catheterization independently they are discharged. In general, this occurs on the third or fourth postoperative day. Intermittent catheterization schedules are determined individually and are adjusted as the patient's voiding ability improves. The patient stops performing catheterization when successive residual urine amounts are 60 ml or less. Intermittent catheterization is performed using a 14 coudé catheter because it avoids trauma to the posterior urethral wall. The shape of the coudé catheter facilitates its passage when the bladder is very full and the sling is tighter than it would be at rest. Every patient is expected to learn (and does learn) intermittent catheterization. Occasionally a patient may develop urinary retention after voiding well and achieving a low residual urine. It is best for the patient to be able to handle this problem herself rather than to rely on a local emergency room for treatment.

## Complications

Complications include inadvertent malposition of the sling within the bladder or urethra, wound infection, prolonged retention, pain related to the sling or sling

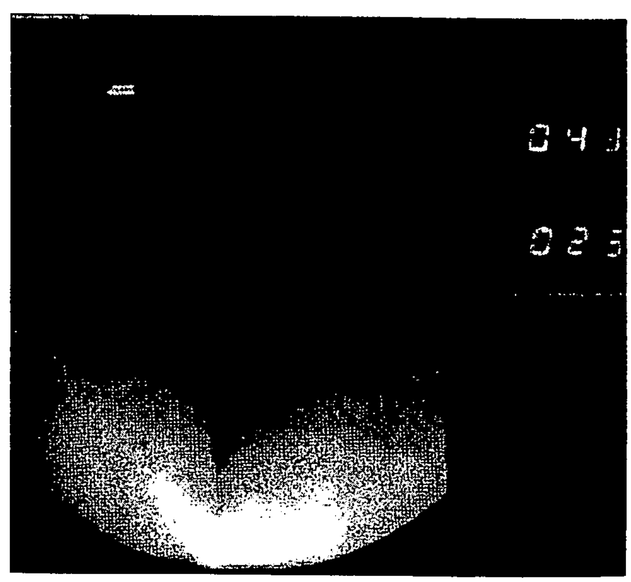


**Figure 31-10** A video urodynamic snapshot of a patient with obstruction after a pubovaginal sling procedure. The pressure drop over the obstructed proximal urethra is 20 cm $H_2O$.

sutures, and potential erosion of the sling into the urethra. Erosion, although fairly common with slings made of synthetic material, has not been reported with autogenous fascial slings to our knowledge. Inadvertent malposition of the sling is associated with bleeding during the operation, which should prompt cystoscopy. Treatment is removal and repositioning of the sling coupled with 7 days of postoperative catheter drainage. In practice, this complication is most likely to occur in patients who are incontinent after pelvic fractures or have failed to respond to retropubic procedures in the past. Wound infections, because they may involve the pledget or the monofilament suture, are a potentially serious complication. Treatment usually requires removal of the foreign material through a small suprapubic incision. Surprisingly, none of the five patients in whom this was done became incontinent.

Patients often complain of a pulling sensation in either inguinal area for 1 to 5 weeks after the procedure. This is usually transient, but if it persists and prevents normal activity, removal of the pledget and the suspension sutures above the rectus fascia will resolve the problem. These patients do not redevelop stress incontinence.

Prolonged urinary retention can be troublesome. It usually occurs because a sling, which prevents leakage, provides too much resistance for a bladder with relatively poor function to overcome. In some instances it is possible to reduce sling tension by having the patient bend forward to void. Attempting to void in the upright position accomplishes the same thing. A full urodynamic investigation is warranted if retention or troublesome urge incontinence or any variety of incontinence develops or persists after a sling procedure. First the ability of the urethra to resist abdominal pressure is determined. If that is satisfactory, the next step is to determine whether the sling is obstructing voiding. Obstruction is assessed by measuring bladder pressure during voiding. When this measurement is made the external sphincter must be demonstrably relaxed and the proximal urethra open. Voiding pressures greater than 30 cm of $H_2O$ are abnormal in a woman and indicate obstruction (Fig. 31–10). Pressures of less than 30 cm $H_2O$ may reflect obstruction in a bladder with poor contractility. Precise identification of obstruction in such a bladder is impossible with the urodynamic equipment that is clinically available. If a bladder contraction cannot be elicited during urodynamic testing, obstruction cannot be assessed. Because management consists of relieving sling tension, it is comforting to have objective evidence of obstruction, although this is not always possible. Take-down of a sling is accomplished using the same steps used in the initial preparation for placement of the sling—namely, transvaginal mobilization of the urethra within its envelope of fascia until urethral mobility has been reobtained.

## REFERENCES


1. Goebell R: Zur operativen Besierigung der angeborenen Incontinentia vesical. Z Urol Gynak 2:187, 1910.
2. Aldridge AA: Transplantation of fascia for relief of urinary stress incontinence. Am J Obstet Gynecol 44:398, 1942.
3. Price PB: Incontinence of urine and feces. Arch Surg 26:1043, 1933.
4. Millen T: Stress incontinence in women. *In* Millen TE (ed): Retropubic Urinary Surgery. Baltimore, Williams & Wilkins, 1947, pp 184–193.
5. McGuire EJ, Wagner FC: The effects of sacral denervation on bladder and urethral function. Surg Gynecol Obstet 144:343, 1977.
6. McGuire EJ, Fitzpatrick CC, Wan J, et al: Clinical assessment of urethral sphincter function. J Urol 150:1452, 1993.
7. McGuire EJ, Woodside JR, Borden TA, et al: Prognostic value of urodynamic testing in myelodysplastic patients. J Urol 126:205, 1981.
8. International Continence Society: Standardization of terminology of lower urinary tract function. Neurourol Urodyn 7:403, 1988.
9. McGuire EJ, Lytton B: Pubovaginal sling procedure for stress incontinence. J Urol 119:82, 1978.
10. McGuire EJ, Bennett CJ, Konnak JA, et al: Experience with pubovaginal slings for urinary incontinence at the University of Michigan. J Urol 138:525, 1987.
11. McGuire EJ: Abdominal procedures for stress incontinence. Urol Clin North Am 12:285, 1985.
12. McGuire EJ, Lytton B, Kohorn EI, et al: The value of urodynamic testing in stress urinary incontinence. J Urol 124:256, 1980.
13. Van Waalwijk van Doorn ESL, Remmere A, Janknegt RA: Extramural ambulatory urodynamic monitoring during natural filling and normal daily activities: Evaluation of 100 patients. J Urol 146:124, 1991.
14. McGuire EJ, Savastano JA: Stress incontinence and detrusor instability/urge incontinence. Neurourol Urodyn 4:313, 1985.

CHAPTER 32

# Use of Fascia Lata for Pubovaginal Sling

Larry T. Sirls, M.D.
Gary E. Leach, M.D.

Although procedures such as artificial urinary sphincter and periurethral injection are receiving more attention, the pubovaginal sling remains the most commonly used procedure for the management of type III stress urinary incontinence. As discussed in previous chapters, the goal of the pubovaginal sling is to restore sufficient outlet resistance to the intrinsically damaged urethra to prevent urine loss with stress maneuvers while avoiding urethral obstruction and allowing spontaneous voiding. A variety of materials have been used as slings, including muscular and fascial tissues as well as synthetic materials. Goebell first reported the use of transplanted pyramidalis muscle as a sling to provide urethral and bladder neck support for stress urinary incontinence.[1] Frangenheim[2] (by including the overlying pyramidalis fascia) and Stoeckel[3] (by plicating the "muscular structures" around the vesical neck in a vaginal approach) modified the procedure. It was Price, however, in 1933 who first used transplanted fascia lata for a pubovaginal sling in a woman with sacral agenesis and urinary incontinence.[4]

This chapter discusses the rationale for using fascia lata as an alternative fascial source for a pubovaginal sling. The anatomy of fascia lata, the technique of harvesting and the technique of transvaginal placement of the sling, and a review of the literature on the use of fascia lata in the sling procedure are presented.

Two critical points influence the outcome of any sling procedure. First is the proper evaluation of the patient with suspected type III incontinence. As discussed in previous chapters, the history (radiation therapy, previous periurethral surgery, or neurologic injury), severity of incontinence, and objective tests, including videourodynamic evaluation and leak point pressures, are essential to confirm intrinsic urethral dysfunction. Identification of the patient with bladder dysfunction (detrusor overactivity or low compliance) is one of the most important objectives of the preoperative evaluation. Patients with type III incontinence can be difficult to study, and it can be particularly difficult in some cases to demonstrate detrusor instability. When the bladder outlet is so compromised that minimal increases in detrusor pressure cause urine loss across the outlet, the pressure rise indicating a detrusor contraction may not be recorded. In this situation, we find it helpful to use a Foley catheter to fill the bladder during the study.[5] When continuous urine loss is seen across the outlet, particularly at low volumes, gentle traction is applied to the Foley catheter. The inflated balloon occludes the bladder neck and urethra, and any detrusor activity can then be recorded. Should detrusor overactivity be documented in a patient with type III incontinence, two options are available. The clinician can prescribe oral anticholinergic agents and later document whether detrusor overactivity is controlled, or a pubovaginal sling procedure can be performed followed by anticholinergic agents, if needed. However, if a patient has preoperative detrusor overactivity, a response to anticholinergic agents preoperatively does not guarantee a satisfactory response in the postoperative period. Patients with detrusor overactivity, as discussed in the next sections, may be at increased risk of failing to respond to the pubovaginal sling owing to persistent urgency and urge incontinence. It is important for neurologically normal patients to realize that there is a small (5%) risk of permanent urinary retention requiring clean intermittent catheterization after a pubovaginal sling. Similarly, it is important for patients with type III incontinence due to neurologic injury to realize preoperatively that the goal of sling surgery is permanent urinary retention and lifelong performance of clean intermittent catheterization.

The second critical point to be addressed in sling surgery is the amount of tension applied to the fas-

cial sling. Too little tension may result in inadequate outlet resistance and thus recurrent or persistent stress incontinence. Too much tension on the sling can cause prolonged difficulty with bladder emptying or chronic urinary retention. In addition, urethral obstruction resulting from a sling procedure may cause postoperative detrusor instability or exacerbation of preexisting detrusor instability. Symptoms of urgency and urge incontinence after a sling procedure can be debilitating and may require a "takedown" of the sling, anticholinergic therapy, or even augmentation cystoplasty. Unfortunately, no standard parameters exist that identify the appropriate degree of sling tension—it remains more an art than a science. We describe the technique of adjusting sling tension in a later section, Placement of the Fascia Lata Sling.

## Fascia Lata: Rationale for Use

We routinely use fascia lata for the pubovaginal sling and prefer it for two reasons. First, fascia lata is uniformly strong regardless of patient age or medical condition. The strength of fascia lata has been studied and compared to that of abdominal rectus fascia.[6] Fascial strips of various widths were harvested and attached to a tensilgraph. Sequential weights were applied, and the weight required to break the strip of fascia was recorded. The results demonstrated that fascia lata had, reproducibly, three to four times more tensile strength than abdominal rectus fascia. Not only is fascia lata stronger than abdominal fascia, the rectus fascia targeted for harvest in patients with type III incontinence is frequently scarred and attenuated.

The second reason we prefer fascia lata for the pubovaginal sling is that less abdominal dissection is required. Instead of the large abdominal incision needed to harvest a 15- to 20-cm segment of abdominal fascia, a small 3-cm abdominal wall incision is sufficient to allow fixation of the fascia lata fascial strip to the pubic tubercle or anterior rectus fascia. Accordingly, there is less chance of anterior abdominal wall nerve injury or entrapment or postoperative hernia. Postoperatively, patients have less abdominal pain and improved ambulation and pulmonary toilet.

Once one is familiar with the technique, harvesting a fascia lata strip is fast and easy. A strip of fascia lata, 20 to 25 cm long, is harvested through two 3-cm transverse incisions in the lateral thigh (the harvest technique will be described in detail later in this chapter). This length provides a strong fascial strip that will support the proximal urethra and bladder neck without an intervening "suture bridge." The additional operating time required for fascia lata harvest is approximately 20 minutes owing to the need to reposition the patient.

## Fascia Lata: Anatomy

The fascia lata is the uppermost subdivision of a complete stocking-like fascial investment of the leg (Fig. 32–1). The bony attachments of the fascia lata are located, from medial to posterior, along the pubic crest, the pubic symphysis, and the ischiopubic ramus extending to the ischial tuberosity. From there, further posterior attachments course along the sacrotuberous ligament to the sacrum and coccyx. The lateral attachments travel anteriorly along the posterior superior iliac spine and iliac crest to the anterior superior iliac spine and then medially again along the inguinal ligament and pubic tubercle, completing the circumferential stocking-like investment. Although the fascia lata is a strong membranous fascia, it is particularly strong laterally, where tendinous reinforcements from the tensor fascia lata and the gluteus muscle are incorporated, forming the iliotibial tract (see Fig. 32–1). The iliotibial tract arises from the crest of the ilium and courses distally to insert on the lateral condyle of the tibia, blending with fibers of the vastus lateralis and biceps femoris muscles.

The only relevant anatomic structure to keep in mind when harvesting the fascia lata is the common peroneal nerve. This nerve, originating from $L_4$–$L_5$ and $S_1$–$S_2$, separates from the sciatic nerve at the popliteal fossa, where it then courses laterally to the back of the head of the fibula. Although normally below the operative field, this nerve could be encoun-

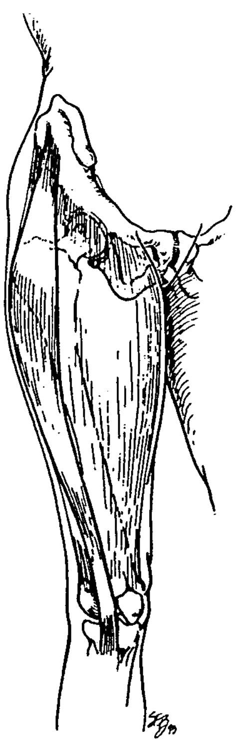


**Figure 32-1** Diagrammatic representation of fascia lata. Note the stockinglike investment of the uppermost aspect of the leg. Laterally, the fascia thickens to form the iliotibial tract.

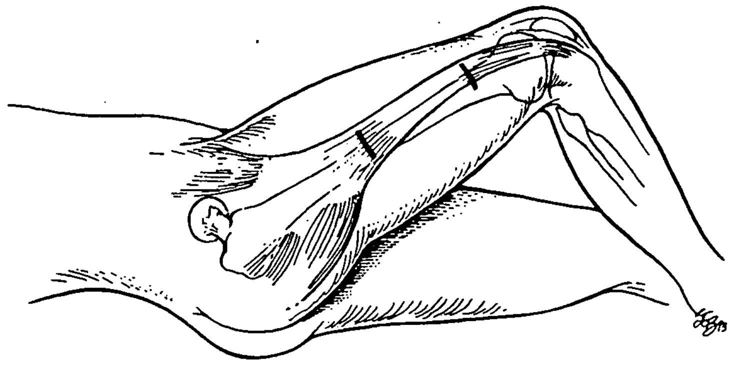


**Figure 32-2** Representation of leg positioning for fascia lata harvest. The knee is flexed and the leg internally rotated at the hip. The bony landmarks (greater trochanter of the femur and lateral condyle of the femur) are easily identified. The two incision sites are indicated over the iliotibial tract.

tered with aggressive dissection distally at the insertion of the iliotibial tract onto the lateral tibial condyle. We have never required this much distal dissection because if additional fascial length is required, proximal dissection toward the thigh is easier. However, common peroneal nerve injury, if it occurs, would be manifest as inability to extend the great toe and sensory loss.

## Preoperative Preparation

It is very important for the patient to demonstrate the ability to perform clean intermittent catheterization preoperatively. This both reinforces the reality that intermittent catheterization will be necessary and eases the transition to intermittent catheterization postoperatively. Patients are instructed to use a povidone-iodine (Betadine) vaginal douche the night before and the morning of sling surgery. Finally, all patients must understand the potential risks and complications of sling surgery, including prolonged or permanent urinary retention, exacerbated or de novo urgency symptoms, and the 10 to 15% risk of recurrent stress urinary incontinence.

## Technique of Fascia Lata Harvest

The patient is placed in the supine position, and anesthesia is administered. The leg from which the fascia is to be harvested is bent at the knee and internally rotated to expose the lateral thigh and allow easy access to the bony landmarks, the lateral condyle of the femur, and the greater trochanter of the femur (Fig. 32–2). Although the lateral condyle and greater trochanter of the femur are not origins or insertions of fascia lata or the iliotibial tract, they are the most useful landmarks for orientation when the leg is flexed. The leg is adequately padded and secured with tape, prepared, and draped. We make two incisions transversely on the lateral thigh (see Fig. 32–2). The first is 5 cm above the lateral condyle of the femur, and the second is 12 to 15 cm proximal to the first along the course of the iliotibial tract. The fascia is identified 2 to 3 cm beneath the skin, and a combination of blunt and sharp dissection easily cleans off the fatty subcutaneous tissue. A narrow Deaver or other retractor is used, and the subcutaneous tunnel between the two skin incisions is developed. A 2-cm-wide segment is marked in the fascia at the proximal incision site, and the fascia is incised in the direction of its fibers with a knife, being careful not to cut into the underlying muscle. A right-angle clamp is used to elevate the fascia off the muscle, and a small Penrose drain is passed beneath the fascial strip. With the retractor elevating the skin between the two skin incisions, long, straight Metzenbaum scissors are used to extend the fascial incisions (Fig. 32–3). Working from each skin incision, the entire fascial strip is mobilized. It is important not to angle the scissors medially, or the fascial strip will have an hourglass deformity. Additional length is easily obtained, if needed, by continuing mobilization proximally. Care should be taken distally, near the insertion of the fascia at the knee, to avoid potential common peroneal nerve injury. When the fascial harvest is complete, two figure-of-eight absorbable sutures are placed to reapproximate the fascial edges, one suture at each skin incision site. Each incision site is drained and closed, and a pressure dressing is applied.

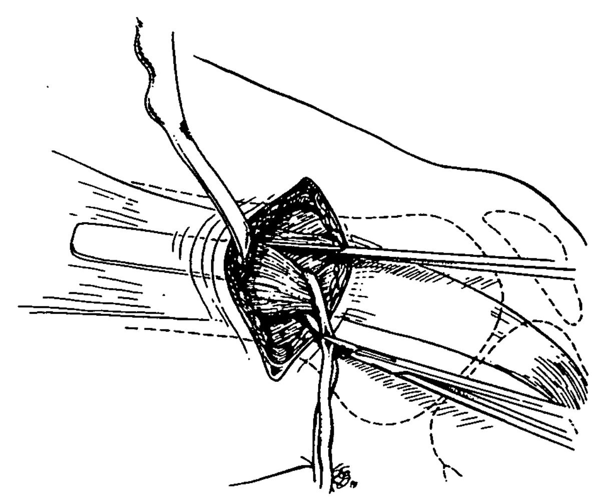


**Figure 32-3** The fascial harvest begins with mobilization of a 2-cm-wide segment; a Penrose drain is used to provide upward traction on the fascial strip. A narrow curved retractor is used to elevate the skin bridge between the two incision sites. Long, straight scissors are used to incise the fascia.

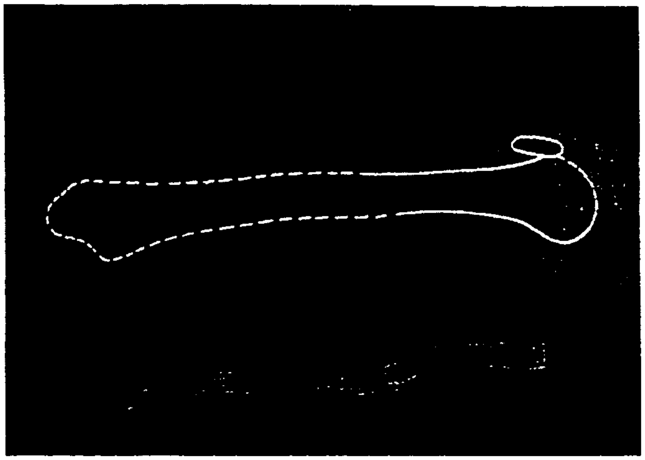


**Figure 32-4** A 1–0 nylon suture is secured to each end of the fascial strip. This helps to transfer the fascial strip from the vaginal incision to the suprapubic position and allows fixation of the fascia to the pubic tubercle or abdominal fascia.

Other authors have reported the use of a fascial stripper to harvest the fascia lata.[7–9] This technique may be performed in a fashion similar to that just described. Our technique of making two small thigh incisions and harvesting the strip with long scissors routinely provides a fascial strip 20 to 25 cm in length without the need for special instruments.

Once the fascia has been harvested, it is cleaned of any remaining areolar tissue. A No. 1 nylon suture is secured to each end of the fascia by running the suture back and forth along the end of the fascial strip, distributing suture tension (Fig. 32–4). This suture will assist with the transfer of the fascial strip from the vaginal incision to the suprapubic position. This heavy nylon suture will be the suture anchoring the sling to either the abdominal wall fascia or, as we prefer, the pubic tubercle on each side.

## Placement of the Fascia Lata Sling

With the patient in the lithotomy position, a Foley catheter is inserted, the posterior weighted vaginal speculum is placed, and a Scott retractor (Lone Star Medical, Houston, TX) is positioned. After hydrodissection using normal saline, an inverted U incision is made, and an anterior vaginal wall flap is mobilized to expose the proximal urethra and bladder neck. Lateral sharp dissection beneath the vaginal wall, at the level of the bladder neck on each side, exposes the endopelvic fascia at the undersurface of the pubic bone. After the bladder is drained, the endopelvic fascia is penetrated, and the retropubic space is bluntly developed. A 3-cm suprapubic incision is made over the insertion of the rectus fascia and pubic bone, exposing each pubic tubercle. A large blunt curved clamp is passed under finger guidance from the suprapubic incision, adjacent to the pubic tubercle and directed laterally to the empty bladder, through the retropubic space and out through the ipsilateral vaginal incision (Fig. 32–5). The large curved clamp is used to ensure that the fascial sling can be passed through the anterior fascia without resistance. One end of the sling is transferred to the suprapubic incision, and the nylon suture is secured to the pubic tubercle (Fig. 32–6). With one end of the sling secured, the surgeon can place the sling in position over the proximal urethra and bladder neck using gentle traction and fasten the fascial strip in place to the periurethral fascia using two interrupted 4–0 Vicryl sutures. This step is particularly important to maintain an even distribution of tension and to prevent the sling from curling or rolling proximally toward the bladder neck. The large clamp is then used to transfer the free end of the sling from the vagina to the suprapubic incision adjacent to the pubic tubercle. At this point, intravenous indigo carmine is given, and cystoscopy is performed to confirm bilateral ureteral efflux and exclude inadvertent bladder injury from the large clamp. With the 20 Fr female cystourethroscope in the midurethra (using the 0-degree lens), the surgeon applies gentle traction to the free end of the sling to ensure that the sling position (under the proximal urethra and bladder neck) is correct. Sling tension is then adjusted under cystoscopic control by elevating the free end of

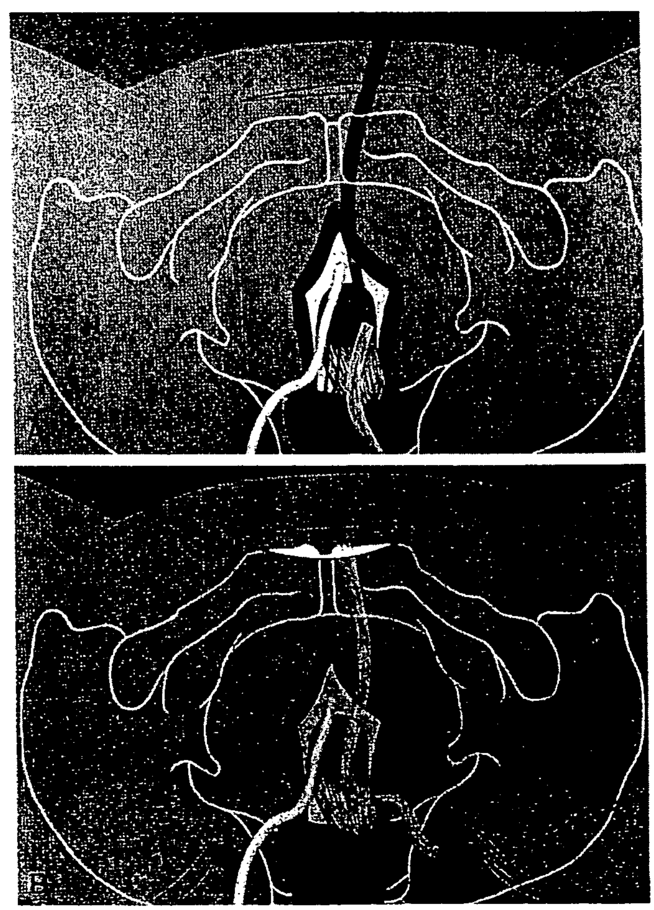


**Figure 32-5** *A,* A large curved clamp is used to transfer the fascia to the suprapubic position. *B,* One end of the sling is secured to the pubic tubercle.

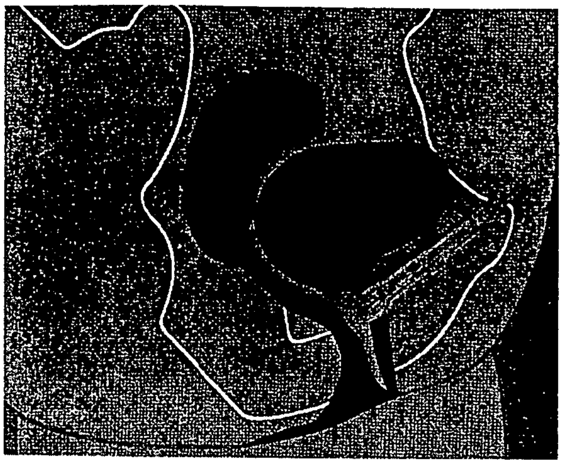


**Figure 32-6** Using fascia lata, adequate outlet resistance is restored to the proximal urethra and bladder neck without an intervening suture bridge.

the sling just enough to see a minimal indentation on the floor of the proximal urethra. When there is excess sling length, a new No. 1 nylon suture is used to secure the fascial strip to the pubic tubercle adjacent to the sling at the appropriate level to maintain the desired tension. Any excess fascia is then "tacked" to the abdominal fascia. The anterior vaginal wall is closed with 2–0 Vicryl in a running locking fashion. The Foley catheter is left to allow gravity drainage, and an antibiotic-soaked vaginal pack is placed.

## Postoperative Care

The Foley catheter and vaginal pack are removed on the first postoperative morning. A trial of voiding is instituted, and the patient is placed on a 1500 ml/day fluid restriction. All patients are reinstructed in the technique of clean intermittent catheterization (which they learned preoperatively) to monitor residual urine volumes. The lateral thigh pressure dressing and the Penrose drain are removed on the second postoperative morning. Patients are routinely discharged from the hospital after 48 hours.

## Results

A review of the literature reporting the efficacy of the pubovaginal sling using fascia lata illustrates two important points.[7, 8, 10–12] First, the efficacy of the fascia lata sling for the treatment of genuine stress incontinence has remained high over the years (Table 32–1). Second, the major cause of failure, resulting in recurrent or persistent incontinence, is detrusor overactivity.

As mentioned, the majority of patients who fail to respond to the pubovaginal sling are found to have detrusor overactivity. Of 35 reported failures, 23 (66%) were attributed to detrusor overactivity. We have evaluated the results of the pubovaginal sling using fascia lata compared to the pubovaginal sling using abdominal fascia. Long-term efficacy in curing stress urinary incontinence and patient satisfaction with outcome were similar. However, the reported incidence of postoperative urgency and urge incontinence had a negative impact on overall patient satisfaction.

Two studies have compared the pubovaginal sling using fascia lata to a sling using foreign material (Mersilene and Gore-Tex).[7, 13] Both fascia lata and the foreign materials were equally effective in curing stress incontinence; however, both series reported an increased risk of complications with the synthetic material. In one series of 17 patients who underwent a pubovaginal sling using synthetic material, three subsequently required removal of the sling, two for erosion into the bladder or urethra.[7]

## Complications

Although urethral erosion is a theoretical concern, only one case of urethral erosion in the 365 cases of fascia lata pubovaginal slings reported in the literature has been recorded.[9] There are three technical points that help minimize the risk of urethral erosion by a fascial sling. First, a wide fascial strip secured in place to ensure an even distribution of tension over the bladder neck and proximal urethra is used. Second, it is important to avoid excessive tension on the sling. Third, synthetic materials should be used with caution. As previously stated, it has been demonstrated that the use of synthetic materials increases the risk of urethral erosion.

No data exist to assess the risk of fascial harvest from the lateral thigh. Beck and colleagues reported eight wound infections in 170 patients but did not indicate whether these were suprapubic or thigh infections.[12] Smith[11] reported two women with lateral thigh "muscle herniation," although this has not been seen by us or mentioned by other authors. In our series, 3 of 18 patients undergoing fascia lata slings have had postoperative cellulitis of one thigh incision, and all responded to outpatient oral antibiotic therapy. Pain from the fascia lata harvest is usually described as an aching, lateral thigh pain. However, all patients are ambulatory on the first postoperative day. Duration of the thigh pain is usually 2 to 4 weeks, but it may last as long as 6 weeks.

## Conclusion

The most important factors in ensuring success in sling surgery are patient selection and proper sling tension. There are definite advantages to the use of fascia lata. Harvesting fascia lata is fast and easy and is associated with minimal morbidity. Sufficient

TABLE 32-1
**Fascia Lata Experience with Pubovaginal Sling**

| Investigator | No. Patients | No. Cured (%) | Reason for Failure (No. Failed from SUI or DI) | Follow-up |
|---|---|---|---|---|
| Ridley (1966) | 36 | 31 (84) | Not stated | Not stated |
| Low (1969) | 43 | 37 (86) | 2 SUI, 4 DI | 6 months–7 years (no mean) |
| Parker (1979) | 50 (38 fascia lata) | 42 (82) | 3 SUI, 2 DI | 1–21 years (no mean) |
| Smith (1982) | 66 | 53 (80) | Not stated | Not stated |
| Beck (1988) | 170 | 157 (92) | 3 SUI, 10 DI | 6 weeks–2 years (no mean, only 17 patients with more than 2 years follow-up) |

*Abbreviations:* SUI, stress urinary incontinence; DI, detrusor instability.

fascial length is routinely obtained, allowing a strong fascial support without an intervening suture bridge. Finally, fascia lata is inherently stronger than rectus fascia and is not subject to the same factors that compromise abdominal fascial integrity such as previous surgical procedures and radiation, which are prevalent in the patient population with type III urinary incontinence.

## REFERENCES


1. Goebell R: Zur operativen Behandlung der Incontinenz mannlichen Harnrohre. Verb Dtsch Gee Chir 2:187, 1910.
2. Frangenheim P: Zur operativen Behandlung der Incontinenz mannlichen Harnrohre. Verb Dtsch Gee Chir 43:149, 1914.
3. Stoeckel W: Über die Verwendung der Musculi pyrimidales bei der operativen Behandlung der Incontinentia urinae. Zentralbl Gynakol 41:11, 1917.
4. Price PB: Plastic operations for incontinence of urine and feces. Arch Surg 26:1043, 1933.
5. Woodside JR, McGuire EJ: Technique for detection of detrusor hypertonia in the presence of urethral sphincteric incompetence. J Urol 127:740, 1982.
6. Crawford JS: Nature of fascia lata and its fate after implantation. Am J Ophthmol 67:900, 1969.
7. Ridley JH: Appraisal of the Goebell-Frangenheim-Stoeckel sling procedure. Am J Obstet Gynecol 95:714–721, 1966.
8. Parker RT, Addison WA, Christopher JW: Fascia lata urethrovesical suspension for recurrent stress urinary incontinence. Am J Obstet Gynecol 135:843–852, 1979.
9. Beck RP, Grove D, Arnusch D, Harvey J: Recurrent stress urinary incontinence treated by the fascia lata sling procedure. Am J Obstet Gynecol 120:613, 1974.
10. Low JA: Management of severe anatomic deficiencies of urethral sphincter function by a combined procedure with fasica lata. J Obstet Gynecol 90:934–939, 1969.
11. Smith JL: Fascia lata paraurethrovesical suspension for the correction of stress urinary incontinence. Am J Surg 143:542, 1982.
12. Beck RP, McCormick S, Nordstrom L: The fascia lata sling procedure for treating recurrent genuine stress incontinence of urine. Obstet Gynecol 72:699, 1988.
13. Ogundipe A, Rosenzweig BA, Karram MM, et al: Modified suburethral sling procedure for treatment of recurrent or severe stress urinary incontinence. Surg Gynecol Obstet 175:173, 1992.

CHAPTER 33

# The Use of Artificial Material for Sling Surgery in the Treatment of Female Stress Urinary Incontinence

Lindsey A. Kerr, M.D.
David R. Staskin, M.D.

The choice of a sling procedure for the correction of genuine stress urinary incontinence (GSI) in the female patient involves placement of autologous or artificial material beneath the bladder neck or proximal urethra. In theory, this graft restores continence not only by suspending the bladder neck and increasing transmission of intra-abdominal pressure to the proximal urethra but also by facilitating coaptation of the urethra and increasing intrinsic urethral closure pressure. There are many materials and techniques available to meet this goal. The evaluation of incontinence leading to the decision to pursue surgery is described elsewhere in this text. Here we will briefly review the findings and indications for sling surgery as well as the choices available and the approaches used when synthetic materials have been selected for sling surgery. Finally, we will describe in detail our choice of sling material, preferred approach, and expected results.

## Indications for Sling Surgery

The most commonly accepted application of sling surgery has been for the treatment of type III stress urinary incontinence. Type III GSI signifies decreased intrinsic urethral closure pressure without altered support of the bladder neck, base, and urethra.[1,2] It is most commonly associated with decreased urethral integrity affecting the ability of the submucosal and muscular layers to coapt and compress the urethral lumen. This deficiency in closure pressure often is the result of devascularization, denervation, or trauma. The underlying cause is variable but can be due to scarring from previous surgery, radiation therapy, catheter trauma, myelodysplasia, or radical pelvic surgery.

Patients with type III GSI classically present with a well-supported pipestem urethra, although type III GSI can occur in patients who have concomitant loss of bladder neck and urethral support (type II GSI). A properly performed sling procedure will also correct the coexisting bladder neck and urethral motion. Another situation in which a sling procedure might be of benefit is type II GSI in a patient in whom poor periurethral tissue makes suture anchoring problematic. These patients often have a history of prior vaginal surgery or vaginal atrophy secondary to hormonal deprivation. Patients with severe obstructive lung disease or obesity who challenge classic type I or II repairs with frequent high-pressure "stress" maneuvers should be considered candidates for sling procedures also. Artificial graft material increases the strength of the repair and prevents erosion of suspension sutures from deficient periurethral or paraurethral tissues. A sling, by creating a stronger "backboard" for the absorption of transmitted intra-abdominal pressure by the urethra, restores continence without allowing the same degree of bladder neck motion. The sling repair prevents "sagging" between the suspension sutures, which is occasionally observed in a classic type II repair.

The last category of patients who may benefit from a sling are those with neurogenic disease and indwelling Foley catheters with leakage around the catheter.[3] These patients are at risk for total urethral erosion because repeated propulsion of the Foley balloon, secondary to detrusor hyperreflexia, leads to loss of urethral integrity. We have found that reloca-

tion of the catheter to the bladder dome through a suprapubic tube, along with anticholinergic therapy and sling placement, decreases both the detrusor hyperreflexia and urinary leakage. We prefer this to bladder neck closure with suprapubic tube placement because bladder neck closure has a high incidence of fistula and leakage.[4]

## Patient Evaluation and Selection

Patients with type III GSI classically present with more severe symptoms of stress incontinence, often with urinary loss at rest. However, many patients with type III GSI may have more typical symptoms of moderate stress incontinence. These patients typically void frequently in an attempt to keep the bladder empty, so their condition can be mistakenly diagnosed as detrusor instability with urgency and frequency. Conversely, in patients with type III GSI and coexisting detrusor instability, detrusor instability may be underdiagnosed because the patients never allow their bladders to fill to a volume that elicits an unstable contraction. This is especially true if GSI is severe and the bladder remains relatively empty. Severe urethral incompetence also permits urine loss during low-pressure bladder contractions—so low, in fact, that the patient may be unaware of the contraction and not report the sensation at the time of urinary leakage. Preoperative instability, if it persists in the postoperative period, will be unmasked as urethral resistance is increased. In these cases, high intravesical pressures may be reached during uninhibited contractions before actual urinary loss occurs. The diagnosis of detrusor instability or hyperreflexia should be established preoperatively so that it can be managed appropriately if it remains postoperatively (see later discussion).

A history of prior failed incontinence surgery should raise a suspicion of intrinsic urethral dysfunction. Previous suspension procedures or cystocele repairs may attenuate or destroy the periurethral tissue planes and limit the surgeon's ability to elevate the anterior wall during subsequent repair without undue tension. Tension predisposes to suture erosion through the periurethral tissue and subsequent failure of the suspension procedure. Prior radiation therapy to the pelvis affects tissue integrity and healing, increasing the incidence of suture erosion and failure. Spinal surgery or radical pelvic surgery predisposes to denervation and subsequent urethral dysfunction. Even events considered less traumatic, such as a simple hysterectomy, vaginal delivery, or postmenopausal urethral atropy, can lead to type III GSI.

The physical examination should focus on both the relevant anatomy and any neurologic abnormalities. A neurologic examination of the lower spinal segments should be part of any evaluation for stress incontinence. In the genitourinary examination the physician should specifically assess the mobility of the urethra and anterior vaginal wall as well as any intravaginal pathology, including the presence of a cystocele, rectocele, enterocele, or uterine prolapse. Suspension of the bladder neck without concomitant cystocele repair may lead to postoperative urethral kinking and urinary obstruction. Any contemplated anterior vaginal wall repair should include evaluation for posterior vault defects because anterior repair only will lead to accentuation of these defects.

In the urodynamic assessment the bladder and outlet must be evaluated during both urine storage and emptying. The tests we perform are the urine flow rate, postvoid residual urine (PVR), cystometry (CMG), and voiding cystourethrography (VCUG). A poor flow rate and increased PVR indicate poor bladder emptying and the possibility of prolonged postoperative urinary retention. The preoperative CMG serves several functions. It is essential to confirm adequate bladder capacity. Actual obstruction of the bladder neck may be required to obtain this measurement, and this is easily performed if a Foley catheter, placed on mild tension, is used during the study rather than a straight urodynamic catheter. If urethral resistance is low, decreased bladder compliance and bladder instability may be missed if fluid is unknowingly allowed to leak around the urodynamic catheter.

Some degree of decreased bladder compliance may be expected in type III GSI patients for a variety of reasons. Severe incontinence that has prevented bladder distention, recurrent infections with bladder fibrosis, or a chronic indwelling Foley catheter or bladder denervation may result in decreased compliance. Conversely, fast-fill cystometry (100 to 150 ml/minute) may artifactually produce low compliance. If low compliance is observed, the study should be repeated at a slower filling rate (20 to 40 ml/minute). Accurate assessment of bladder filling pressures is essential in these patients. Elevated intravesical filling pressures put the upper tracts at risk, especially if the pressures maintained are chronically above 35 to 40 cm $H_2O$. Anticholinergic medication will not help the compliance of a fibrotic bladder. These patients may need a bladder augmentation in addition to sling surgery. Demonstrable detrusor instability or hyperreflexia, on the other hand, can be managed with anticholinergics. One of the proposed causes of detrusor instability is the entrance of urine into the proximal urethra, which is presumed to stimulate a bladder contraction. Demonstration of normal detrusor contractility suggests that adequate postoperative bladder emptying can be obtained. However, the inability to elicit a voluntary bladder contraction is common during cystometric evaluation of women patients. It should not be cause for alarm if the history and physical examination are otherwise unremarkable. Patients with a prior history of peripheral neurologic disease often present with a noncontractile bladder, and long-term intermittent catheterization should be anticipated in these patients after surgical intervention.

The major postoperative complications are persis-

tent urgency, frequency, and possibly urge incontinence. Postoperative instability may be classified as persistent or de novo. McGuire and colleagues noted improvement in the symptoms of bladder instability in 20 of 29 patients who underwent sling procedures.[5] The development of de novo instability has been reported in 10 to 40% of patients and may be secondary to bladder outlet obstruction, although it is possible that a diagnosis of detrusor instability was missed on preoperative cystometric assessment. Preoperative detrusor hyperreflexia should not be expected to resolve, because its neurogenic origin will be unaffected by the surgery. The decision to place a sling in a patient with detrusor instability or hyperreflexia is based on the expectation that the uninhibited contractions will resolve postoperatively or that they can be controlled with anticholinergic medication.

## Selection of a Surgical Procedure

A variety of techniques have been described for the performance of sling surgery. The placement of autologous, heterologous, or artificial material beneath the urethra is presumed to provide an increase in urethral compression and a sturdier "backboard" than classic suspension procedures. This backboard functions to transmit abdominal pressure efficiently to the bladder neck and proximal urethra, thereby increasing urethral closure pressure during stress maneuvers.

Differences in sling techniques can be classified by the surgical approach and by the sling material employed. We concentrate on artificial materials in this chapter. The selection of surgical approach should be made with several considerations in mind. The first is the need to minimize morbidity and ensure the optimal rate of success. The surgeon should therefore use an anatomically familiar approach to ensure meeting both these criteria. Technically, accurate placement of the sling beneath the bladder neck and proximal urethra with a broad base of compression, and the simple and safe passage of the supporting arms of the sling through the retropubic space for attachment to the rectus fascia, pubic bone, or various other ligaments are required. The optimal approach minimizes the risk of damage to the bladder, bladder neck, urethra, and vagina. Abdominal, abdominovaginal, and vaginal approaches have been described.

The pure abdominal approach involves entrance into the retropubic space and placement of the sling beneath the proximal urethra and bladder neck without making a vaginal incision. The abdominovaginal approach combines dissection into the retropubic space through the abdomen with a vaginal incision that aids in accurate perforation of the arms of the sling and in placement of the body of the sling beneath the urethra. The vaginal approach requires a vaginal incision for placement of the body of the sling, and blind instrument passage of the arms of the sling through the retropubic space to a location above the rectus fascia without opening the rectus muscles. The approach to placement of the sling should be determined prior to performance of the procedure to place the patient in the optimal position (supine, relaxed lithotomy, full lithotomy) for surgical exposure.

### THE ABDOMINAL APPROACH

Use of the pure abdominal approach should be limited to patients in whom the lithotomy position is contraindicated (e.g., decreased mobility of the hip or severe spinal problems), the rare circumstance when a sling is elected intraoperatively (e.g., inability to obtain sufficient periurethral or paraurethral tissue mobilization to perform a classic suspension), or when positioning of the legs in the lithotomy position limits the exposure needed for concomitant abdominal procedures (e.g., bladder augmentation, abdominal hysterectomy). If the lithotomy position is contraindicated, a frog-legged position is preferred because it affords vaginal access for intraoperative palpation of the bladder neck during sling passage.

The tissue superficial to the mid and distal urethra consists of periurethral fascia and overlying anterior vaginal wall. There is limited fibroareolar tissue space for dissection in this plane. Anatomically, this space is too distal to be used for sling placement because postoperative obstruction is the all-too-common result. The proper plane for dissection is at the level of the proximal urethra or vesical neck in the vesicovaginal plane. If prior incontinence surgery or cystocele repair has been performed, dissection within this plane beneath the bladder neck may be more difficult because of scar tissue. In a pure abdominal approach, the bladder should be opened prior to dissection of the tunnel for the sling. Transvesical exposure of the bladder neck allows palpation during the dissection beneath the bladder neck and visualization of the bladder neck area to ensure that the sling has not been placed within the bladder or urethra. Early postoperative sling erosion into the urethra is too often a misnomer for a sling that was placed through the urethral wall at the time of surgery. To avoid damage to the urethra or bladder neck, the plane for dissection of the sling tunnel should begin proximal to the level of the bladder neck where the vesical fascia can be separated more easily from the anterior vaginal wall. Distal dissection beneath the urethra is facilitated once this plane has been developed more proximally.

When the plane beneath the bladder neck and proximal urethra is difficult to develop, it may be best to enter the vagina. The vaginal wall will subsequently have to be mobilized to cover the artificial sling because the vagina will not granulate over the foreign material, but this choice avoids the more ominous urethral injury.

### THE ABDOMINOVAGINAL APPROACH

The addition of a vaginal counterincision for sling placement is highly recommended when the abdominal approach is used because it provides improved exposure. The abdominovaginal approach (Fig. 33–1) combines an abdominal incision, which is used for dissection within the retropubic space, with an anterior vaginal wall vertical flap incision, which allows direct exposure beneath the bladder neck. This approach permits formation of the paraurethral tunnels by combined abdominal and vaginal routes. A relaxed lithotomy position provides adequate exposure for the abdominal and vaginal portions of the surgery. The ability to pass the sling below the urethra and bladder neck without fear of unintentionally perforating the anterior vaginal wall significantly decreases the amount of retropubic space dissection required for exposure of the bladder neck. A vertical or Pfannenstiel skin incision can be performed, the size of the incision being determined solely by the need for retropubic space exposure. However, the need for an abdominal incision to allow entrance into the retropubic space is obviated by the pure vaginal approaches.

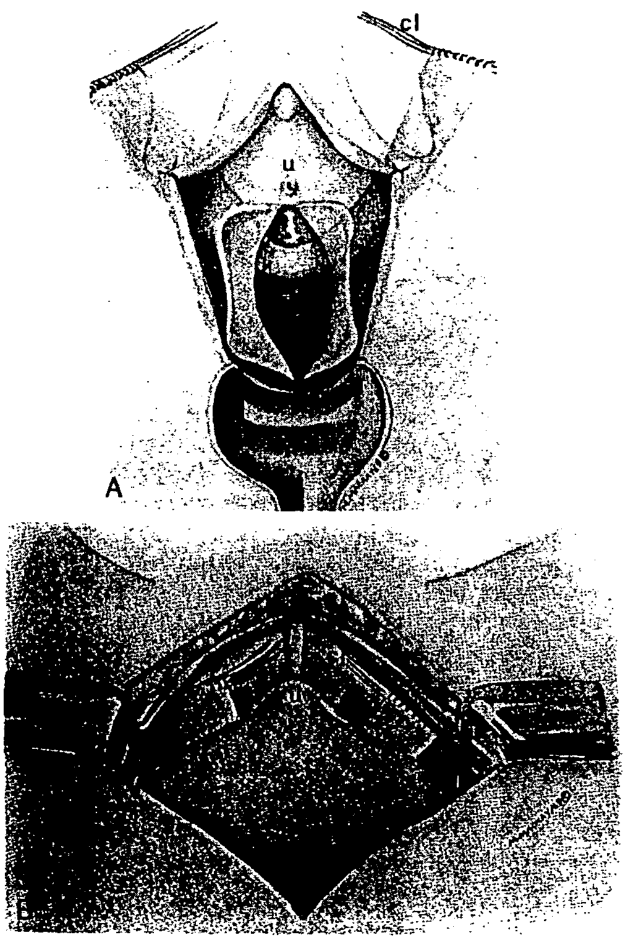



**Figure 33–1** Abdominovaginal approach using a Marlex polypropylene mesh sling. Marlex is attached to Cooper's ligament after extensive dissection of the bladder neck. *A*, Vaginal incision. u, urethra; cl, Cooper's ligament. *B*, Abdominal incision. See text for discussion. (From Morgan JE: A sling operation using Marlex polypropylene mesh for the treatment of recurrent stress incontinence. Am J Obstet Gynecol 106[3]:369, 1970.)

### THE VAGINAL APPROACH

Like the abdominovaginal approach, the vaginal approach uses a vertical or flap incision in the vaginal wall for placement of the sling at the level of the bladder neck under direct vision. Using this strategy, the supporting arms of the sling are passed with a clamp, a pilot suture, or a suspension needle through tunnels or canals formed by instrument or finger dissection within the retropubic space. The tunnels can be formed from above (abdominally to vaginally) or below. The tunneling maneuver eliminates the need for splitting the rectus musculature and opening the retropubic space. A more acute lithotomy position can be employed for improved vaginal exposure. A small abdominal skin incision to the level of the rectus fascia is required for securing the arms of the sling.

The advantage of the vaginal approach is the decreased exposure of the retropubic space compared with that in the previously discussed approaches. The primary disadvantage of the vaginal approach is the increased chance of bladder, bladder neck, or urethral injury during blind passage of the arms of the sling. The vaginal approach is reviewed in detail later in this chapter.

## Choice of Sling Material

Artificial slings have been fashioned as continuous pieces of material that comprise both the body and the arms of the sling or, alternatively, as patches or grafts placed beneath the urethra with the supporting arms provided by nonabsorbable suture. One obvious advantage over autologous material is the availability of the material and lack of dependence on factors such as previous surgery, body habitus, or experience in harvesting the chosen graft. The use of artificial material increases the risk of infection and possibly subsequent erosion into the urethra or vagina, but the biocompatibility of Marlex, Silastic, Gore-Tex, and Mersiline has been demonstrated. Broad-spectrum intravenous and oral antibiotics that provide gram-positive, gram-negative, and anaerobic coverage and thorough preoperative vaginal preparation can significantly decrease the incidence of infection. Risk of infection is also decreased by employing the least amount of foreign material necessary to correct the incontinence. We typically use a patch of sling material suspended beneath the urethra by nonabsorbable suture. If infection occurs it is easier to remove a patch (leaving the sutures in place) than to try to remove a full-length sling. In our experience, patients who have had the patch removed because of

infection have remained dry. Presumably their continence is due to continued support from scar tissue that has formed. We have not removed any patches until after a waiting period of 3 months from the original date of surgery, so that scarification is maximal. Urethrovaginal erosion caused by artificial material is often related to uneven compresson of the urethra (a thin strip beneath the urethra placed on excessive tension) or to technical errors in sling placement (entrance into the urethra or bladder neck during sling placement). The durability of the sling material and the contribution of scarring around the sling to the long-term surgical result have not been established. Vaginal erosion may be caused by infection of the graft material, necessitating its removal. Scarring is probably significant and may account for success in cases in which the sling has had to be removed, yet the patient remains continent.

## Synthetic Slings Placed Using an Abdominal or Abdominovaginal Approach

Mersilene was the first artificial material used as a sling to support the vesicourethral junction for continence (Fig. 33–2).[6, 7] Unfortunately, Mersilene gauze was reported to erode and cause obstruction when used with these techniques.[7, 8] The use of Silastic, Gore-Tex, and Marlex in surgery has been demonstrated in a variety of capacities with some of the same problems. Morgan and coworkers reported on their experience with a Marlex sling procedure.[9, 10] The procedure was based on a two-team, abdominovaginal operative technique, unchanged since its description 15 years before, wherein the bladder neck is extensively dissected and replaced in a midretropubic position on a hammock of Marlex mesh attached to Cooper's ligament (see Fig. 33–1). The success rate was 81% in the 208 patients followed for more than 5 years. Success was defined as lack of need for pads and the ability to resume normal activity without stress incontinence. Two slings eroded into the urethra, requiring revision in these patients. Treatment of persistent outlet obstruction in 12 patients was noteworthy in that anterior transurethral resection of the bladder neck was the procedure of choice.

Stanton and colleagues described the use of a Silastic sling.[11, 12] A 19- × 1-cm sling was fashioned from a medical-grade Silastic sheet with a double thickness of sheeting used for the central portion and a triple thickness used for the arms. Through a Pfannensteil incision the sling was anchored to the pectineal ligament bilaterally. Objective and subjective cures were achieved in 81% of patients at 3 years. Of concern was the high frequency of de novo instability occurring postoperatively. Eleven percent of patients complained of severe voiding difficulty postoperatively and required release or removal of the sling. Complications included vaginal entry or bladder and urethral injury and in some cases development of urethrovaginal fistula that required removal of slings in 8 of 125 cases. In all, 20% of slings had to be removed.

Horbach and associates and Bent and colleagues reviewed their experience with a Gore-Tex suburethral sling in 115 patients (Fig. 33–3).[13, 14] The

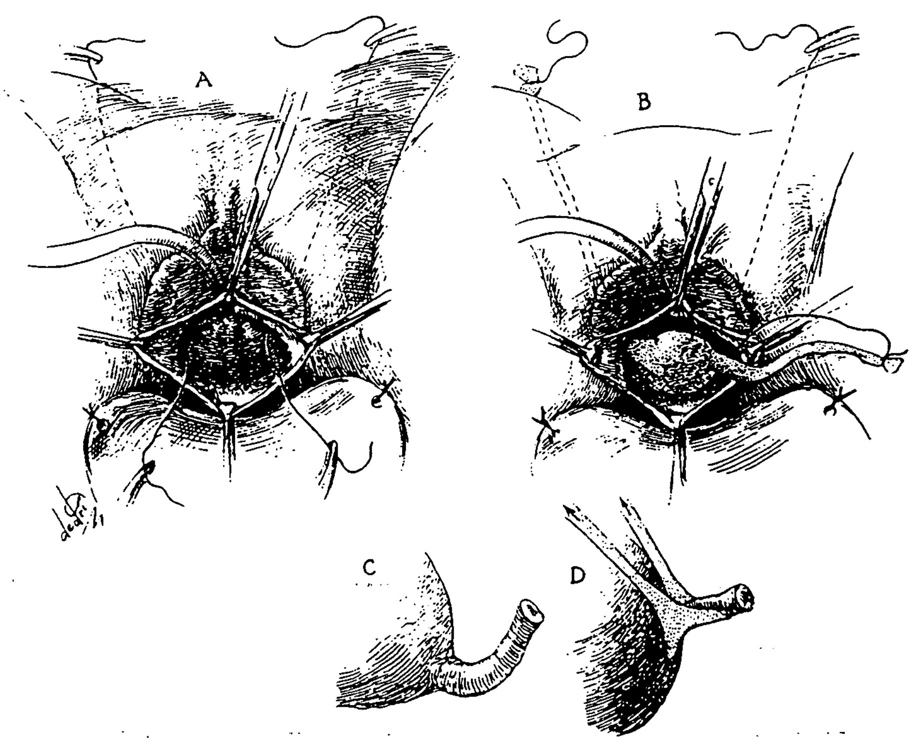



**Figure 33–2** Abdominally placed Mersilene gauze mesh hammock. *A,* Two inguinal incisions have been made and the rectus aponeuroses incised bilaterally. The anterior vaginal wall is opened, and two silk sutures now traverse the retropubic space from vagina to abdomen. *B,* The Mersilene gauze is tacked in the periurethral fascia in the midline and the ends are sewn to the rectus aponeurosis. *C* and *D,* Correction of vesicourethral support by the hammock. (Reprinted with permission from the American College of Obstetricians and Gynecologists [Obstet Gynecol 1973, 41:88.])

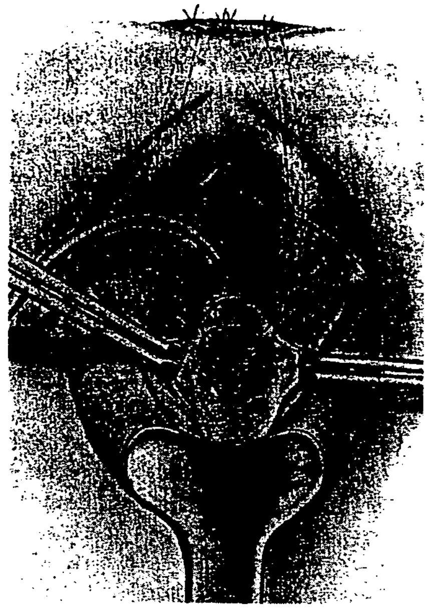


**Figure 33-3** Gore-Tex suburethral sling. Placement at the level of the urethrovesical junction after plication of the suburethral fascia in the midline at this point. See text for more detail. (Reprinted with permission from the American College of Obstetricians and Gynecologists [Obstet Gynecol 1988, 71:648.])

vagina was incised longitudinally from near the vaginal apex to 1.5 cm proximal to the urethral meatus. The vaginal epithelium was dissected laterally off the underlying fascia to the descending pubic rami. After plication of the periurethral fascia over the proximal urethra, the Gore-Tex graft was fixed in place at the level of the urethrovesical junction. The endopelvic fascia was perforated, and counterincisions were made through the rectus fascia so that the arms of the sling could be secured to this fascia after they had been passed through the retropubic space. A cure rate of 82.4% was obtained, but a number of rejections occurred. Twenty-four patients experienced vaginal or abdominal reaction to the sling material, and 23 required removal of the sling. It may be postulated that reaction to the sling material is related to the large amount of sling surface area exposed to the body (66 $cm^2$). Two other patients had pain or urinary retention necessitating sling removal. Seventy-four percent of these patients remained continent. Histologic examination revealed gram-positive cocci in all Gore-Tex slings that were examined after removal.

## Gore-Tex Patch Placement Using the Vaginal Approach

Our preferred approach to patients with type II and type III stress incontinence is vaginal dissection and placement of a suburethral patch fashioned from Gore-Tex and suspended by two nonabsorbable Gore-Tex sutures (Fig. 33–4). Rather than the large strip of Gore-Tex used by Bent and colleagues, a small patch suspended by bilateral sutures is fashioned (7 $cm^2$ exposed surface area). This vaginal approach is a modification of the Pereyra operation as described by Raz and incorporates many of the principles that have been described for the transvaginal needle bladder neck suspension.[15]

### PREOPERATIVE PREPARATION

The patient is instructed to have a clear liquid dinner, use a limited enema, and perform a Betadine douche the night before surgery. Preoperative intravenous antibiotics are administered 1 hour prior to surgery and include a third-generation cephalosporin or gentamicin and ampicillin.

### POSITIONING AND EXPOSURE

The patient is positioned in a full lithotomy position. After a weighted vaginal speculum is inserted, a 16 Fr Foley catheter is placed for drainage. The bladder neck is identified by palpating the Foley balloon, taking care not to place any tension on the catheter (see Fig. 33–4*B*). Ten to twenty-five ml of sterile saline is injected into the vesicovaginal space at the level of the bladder neck and laterally to facilitate dissection. An Allis clamp is placed 1.5 cm distal to the bladder neck, and a 5- to 6-cm longitudinal incision is made. Antibiotic solution is used to irrigate all incisions during the surgery. Dissection is undertaken laterally in the vesicovaginal plane, parallel to the periurethral fascia, as far as the inferior aspect of the pubic rami. Care should be taken not to dissect superficially, or troublesome bleeding may be encountered as one mistakenly dissects into the medial aspect of the labia minora. If this occurs, a figure-of-eight suture may be placed through the superior and inferior portions of the labia, to be removed at the end of the surgery.

### ENTRANCE INTO THE RETROPUBIC SPACE AND DISSECTION THEREIN

The retropubic space is entered by sharp perforation at the 2 o'clock and 10 o'clock positions by cupping the Metzenbaum scissors with the left hand, points curved outward, and guiding them with the left index finger along the internal aspect of the inferior pubic ramus (see Fig. 33–4*C*). The points of the scissors are used to perforate the attachment of the periurethral fascia on the inferior pubic ramus, allowing entrance into the retropubic space. The scissors are opened and then withdrawn in the open position, and the left index finger is placed in the defect. Blunt perforation is not used because it creates a defect through the weakest portion of the periurethral tissue, resulting in poor tissue for anchoring sutures. The index finger is advanced laterally through the perfora-

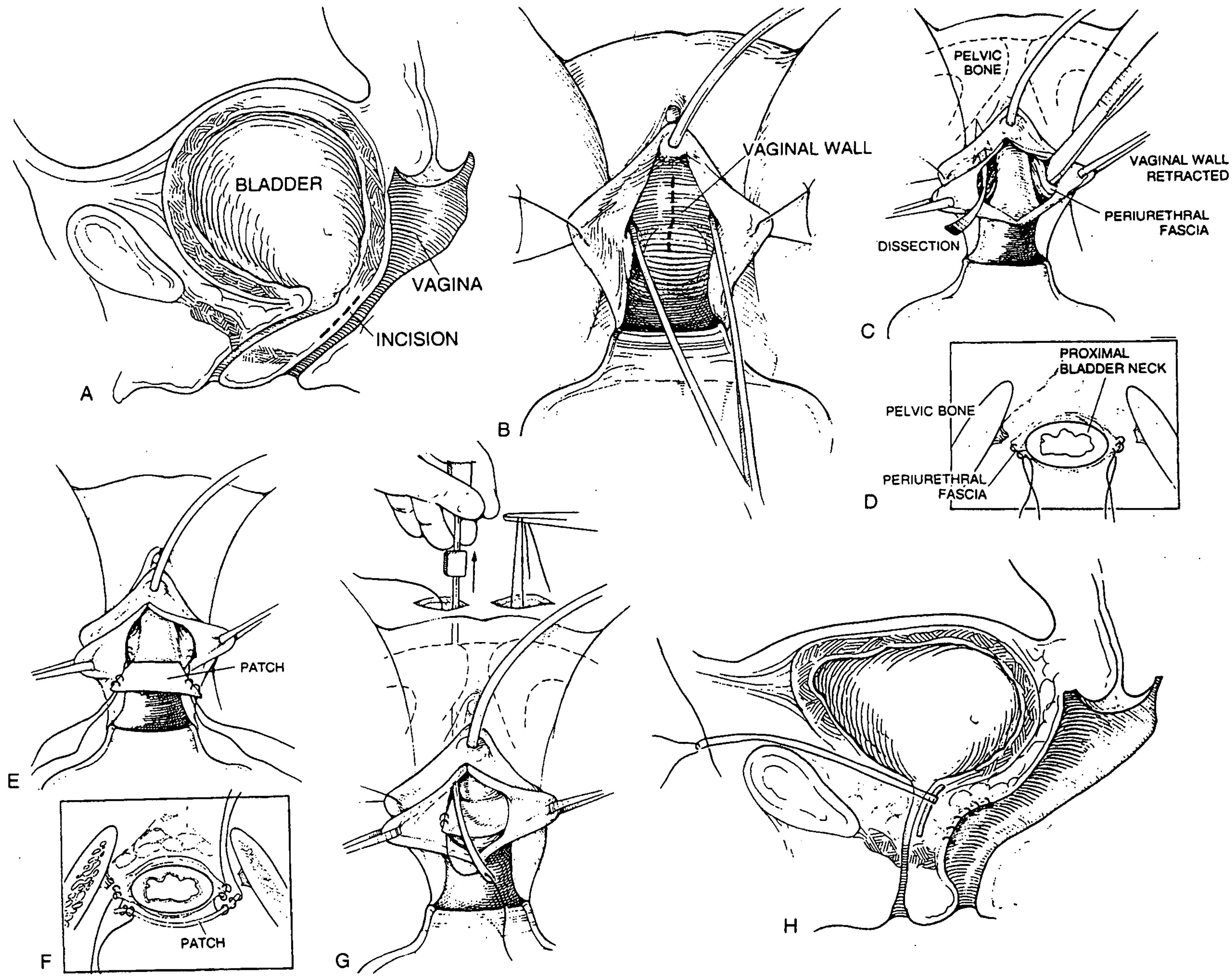



**Figure 33-4** *See legend on opposite page*

tion lateral to the pubourethral attachments and then immediately superiorly along the surface of the pubic bone within the retropubic space. The bladder neck is further mobilized by sweeping the periurethral attachments from the inferior surface of the pubic rami.

The pubourethral ligaments may be palpated medial to the dissecting finger, and dissection of these structures or dissection across the midline above these structures is not required. The same maneuver is now performed on the patient's right side. The now-completed mobilization of the bladder neck and anterior vaginal wall is a distinct advantage that is provided only with entrance into the retropubic space. Mobilization of the anterior vaginal wall and bladder neck allows elevation with decreased tension on the suspending sutures.

Bleeding during these maneuvers is usually encountered at the edge of the periurethral fascia, which has been mobilized from the pubic bone. Attempts to obtain hemostasis by clamping or cauterizing should be reserved until after the bladder neck suspension sutures have been placed because they often incorporate the area responsible for the majority of the bleeding. Frequently passage and elevation of suspension sutures may be necessary to appreciate the full hemostatic effect of the placement of suspension sutures.

## SUTURE AND PATCH PLACEMENT

A 2–0 Gore-Tex suture on a curved needle (THX-26) is used to secure the medial edge of the periurethral fascia at the level of the bladder neck (see Fig. 33–4*C*, *D*). The needle is left intact for incorporation of the patch. A trapezoid (4- × 3- × 1.5-cm) Gore-Tex soft tissue patch (1 mm thick) is placed suburethrally in the vesicovaginal plane beneath the periurethral fascia, and the base edges are incorporated into the suspension sutures (see Fig. 33–4*E*). If periurethral tissue is found to be severely deficient, a free Gore-Tex stitch is incorporated into the posterior surface of the anterior vaginal wall at the bladder neck level and then attached to the patch for suspension. The advantage of incorporating periurethral fascia is that it fixes the patch and prevents it from sliding into the retropubic space during suture elevation. The patch is then advanced into a suburethral position. An antibiotic-soaked sponge is placed in the vaginal incision, and attention is turned to the abdomen.

## THE ABDOMINAL INCISION AND PASSAGE OF THE SUTURES

Two 2-cm horizontal abdominal incisions are made down to the rectus fascia one fingerbreadth above the pubic bone, each 1 cm from the midline. A suspension needle is then placed through the medial aspect of one of the skin incisions and through the rectus fascia near the midline. Using finger guidance from below, the needle is guided out of the ipsilateral vaginal incision, taking care not to enter the bladder. (see Fig. 33–4*F*, *G*). The suture is threaded through the eye of the needle and transferred out of the abdominal incision with withdrawal of the needle. The second ipsilateral transfer is begun 2.5 to 3 cm laterally to the first. The same procedure is carried out on the opposite side. Cystoscopy confirms the absence of sutures within the bladder and accurate placement of a 12 Fr cystocath tube for suprapubic urinary drainage. Evidence of intravenously administered indigo carmine in the urine excreted from both ureteral orifices and elevation and compression of the bladder neck by the patch is sought at this time as well.

Following anterior vaginal wall closure with absorbable suture, the patch is secured by tying the ipsilateral sutures under minimal tension and then by tying the suture strands to the contralateral sutures under the midline skin bridge (see Fig. 33–4*H*). The lack of appreciable tension cannot be overemphasized because minimal elevation and compression are needed, and too much tension will result in obstruction. The abdominal incisions are closed with absorbable suture, and a vaginal pack may be inserted.

## OTHER DIFFICULTIES ENCOUNTERED

Dense scarring from prior surgery may be encountered near the area of the bladder neck or pubovesical attachments, especially in the area of prior suture

**Figure 33–4** Gore-Tex patch suspension. *A*, Sagittal view of bladder and vaginal incision. *B*, The labia are sutured laterally (optional). A Foley catheter is placed in the bladder. The location of the bladder neck can be determined by palpating the Foley balloon, using extreme care not to pull the catheter during this maneuver. Forceps measure the distance between the vaginal fornices at the level of the bladder neck. This measurement is used to determine the width of the patch. The vaginal incision (5 to 6 cm) begins just proximal to the bladder neck. *C*, Lateral dissection is performed in the vesicovaginal plane. The periurethral fascia is dissected from the internal surface of the pubic bone using a combination of sharp and blunt dissection. *D*, Transverse view at the level of the bladder neck after suture placement. *E* and *F*, Following placement of the suspension suture in the periurethral fascia, the sutures are incorporated into the patch in a helical fashion (three bites). *G*, The patch is advanced along the suspension sutures, and at the level of the bladder neck it is placed loosely beneath the periurethral fascia. Two stab incisions are made one fingerbreadth above the pubic bone; dissection is ·ken down to the rectus fascia. The Gore-Tex sutures are transferred suprapubically, using the suspension needle via the stab incisions. ., Completed repair with Gore-Tex patch in place.

placement. We have found that a renal pedicle clamp cupped within the right hand and with the points slightly extended provides a controlled way to mobilize this scar tissue off the bone as one proceeds superiorly. If the scarring is extremely dense, mobilization can be stopped just superior to the bladder neck area without proceeding to the inferior surface of the rectus muscles. The suspension needle can be relied on to traverse this scarred area aided by cystoscopic guidance. The advantage of complete bladder neck mobilization is that it facilitates bladder neck repositioning and allows finger guidance of the needle through the entire retropubic space, thus avoiding entrance into the bladder. In the presence of dense scarring, this mobilization may have to be less aggressive to avoid bladder neck perforation.

If the bladder neck or urethra is entered during dissection, use of the Gore-Tex patch may be contraindicated because of the increased risk of graft infection. It is our routine practice to switch to a vaginal wall or fascial graft in these circumstances.

### POSTOPERATIVE CARE

A vaginal pack is not used routinely, but if one is placed it is removed on the first postoperative day. The suprapubic tube is clamped the day after surgery, and voiding trials begin. The patient is taught how to open the suprapubic tube and check the postvoid residual urine every 2 to 4 hours. When the postvoid residual urine remains less than 100 ml, the suprapubic tube is removed. If this period of time lasts longer than 2 weeks, self-intermittent catheterization is begun.

### OPERATIVE RESULTS

We have used a Gore-Tex patch suspension procedure for correction of primary (42 first operations) and recurrent (39 second and 19 third operations) type II genuine stress incontinence in 100 patients.[16] The age of the patients (6 patients aged 30 to 39, 26 aged 40 to 49, 24 aged 50 to 59, 25 aged 60 to 69, 14 aged 70 to 79, and 5 aged 80 to 89) did not affect the decision about use of the graft material. All patients underwent preoperative videourodynamic evaluation (uroflow, PVR, provocative $CO_2$-CMG, urethral pressure profile [UPP], VCUG) as described earlier; those with persistent symptoms had postoperative videourodynamic evaluation. The initial 32 patients had a history of unsuccessful prior surgery, chronic obstructive pulmonary disease, obesity, or corticosteroid use, making them excellent candidates for sling repair. Of the next 62 patients, 39 were undergoing their first repair for stress urinary incontinence. These patients had either poor anterior vaginal wall mobility or deficient periurethral tissue (or both), which limited the ability to elevate and fix the bladder neck. We followed the technique described earlier without modification.

Follow-up was more than 2 years for 11 of 14 patients, more than 1 year for 53 of 60 patients, more than 9 months for 72 of 81 patients, and more than 6 months for 91 of 100 patients. Either phone contact or office visits were undertaken as well as repeat urodynamic evaluation if patients were symptomatic postoperatively. In three patients the Gore-Tex patches (but not the sutures) were removed owing to patch infection. All three reported significant vaginal discharge within 8 weeks of surgery. Two remain continent. Four patients had persistent symptoms of obstructive voiding (confirmed by pressure-flow studies), and their patches were vertically incised (6, 8, 12, and 14 weeks postoperatively) but not removed. All four remain continent without obstruction (three patients are continent more than 1 year after the incision). Presumably, continence in these patients is due to continued support from scar tissue formation. Six patients experienced onset of symptoms of urinary urgency and frequency, and two of these had urge incontinence demonstrable on postoperative CMG. These patients were managed by anticholinergic therapy. One patient has persistent incontinence, which is type III by urodynamic evaluation.

In summary, 89 of 91 patients available for follow-up were cured of stress urinary incontinence with the use of the Gore-Tex patch sling. This procedure eliminates the major cause of surgical failure for type II GSI, namely, suture failure. The procedure is well tolerated, with a second procedure being required in 7 of 91 patients. In only 2 patients of 91 was de novo detrusor instability seen.

## Conclusion

We have reviewed the indications for sling surgery and the evaluation of patients thought to be surgical candidates for this procedure. We have discussed the options available for surgical approach, namely, the abdominal, abdominovaginal, or vaginal routes. We have presented our choice of the Gore-Tex patch sling as an evolution of prior techniques and materials that provides the best results in properly selected patients.

### REFERENCES

1. Staskin DR, Zimmern PE, Hadley HR, Raz S: The pathophysiology of stress incontinence. Urol Clin North Am 12(2):271, 1985.
2. Blavis J, Olsson C: Stress incontinence: Classification and surgical approach. J Urol 139:727, 1988.
3. Kerr LA, Witt M, Staskin DR: Transvaginal bladder neck closure versus a transvaginal obstructive sling as an adjunct to the treatment of total urethral incontinence managed with suprapubic tube drainage. In press, 1995.
4. McGuire EJ, Woodside JR, Borden TA, Weiss RM: Prognostic value of urodynamic testing in myelodysplastic patients. J Urol 126:205, 1981.
5. McGuire EJ, Bennet C, Konnak J, et al: Experience with pubovaginal slings for urinary incontinence at the University of Michigan. J Urol 138:525, 1987.

6. Moir JC: The gauze-hammock operation. J Obstet Gynaecol Br Commonwlth 75:1, 1968.
7. Nichols DH: The Mersilene mesh gauze hammock for severe urinary stress incontinence. Obstet Gynecol 41:88, 1973.
8. Melnick I, Lee RE: Delayed transection of urethra by Mersilene tape. Urology 8(6):580, 1976.
9. Morgan JE: A sling operation using Marlex polypropylene mesh, for treatment of recurrent stress incontinence. Am J Obstet Gynecol 106(3):369, 1970.
10. Morgan JE, Farrow GA, Stewart FE: The Marlex sling operation for the treatment of recurrent stress urinary incontinence: A 16-year review. Am J Obstet Gynecol 151(2):224, 1985.
11. Stanton SL, Brindley GS, Holmes DM: Silastic sling for urethral sphincter incompetence in women. Br J Obstet Gynecol 92:747, 1985.
12. Stanton SL: Suprapubic approaches for stress incontinence in women. J Am Geriatr Soc 38:348, 1990.
13. Horbach NS, Blanco JS, Ostergard DR: A suburethral sling procedure with PTFE for the treatment of genuine stress incontinence in patients with low urethral closure pressure. Obstet Gynecol 71:648, 1988.
14. Bent AE, Ostergard DR, Zwick-Zaffuto M: Tissue reaction to expanded polytetrafluoroethylene suburethral sling for urinary incontinence: Clinical and histologic study. Am J Obstet Gynecol 169(5):1198–1201, 1993.
15. Raz S: Modified bladder neck suspension for female stress incontinence. Urology 17:82, 1981.
16. Staskin DR, Kerr LA: The Gore-Tex patch transvaginal needle suspension: Indications, technique, results and followup of 100 consecutive patients. J Urol 149:291A, 1993.

CHAPTER 34

# Technique of Rectangular Fascial Sling

Ashok Chopra, M.D.
Shlomo Raz, M.D.
Lynn Stothers, M.D.

The use of fascial slings has a distinct role in the treatment of incontinence, as described in Chapters 31 to 33. This chapter will not repeat the points these authors have raised but rather will present a simplified technique of performing an abdominal rectus fascial sling.

## Considerations

Different surgeons use formal fascial slings with various degrees of emphasis. Some authors use this procedure for all patients with stress urinary incontinence (SUI); others restrict its use to patients with type III incontinence. Since techniques of vaginal wall sling were developed, we have limited the use of formal fascial strip slings in our practice. At UCLA we use these slings primarily for patients with poor vaginal tissues, for some patients who have had radiation to the pelvis, for those undergoing creation of a neourethra, and for those who have failed to respond to previous vaginal sling surgery.

Our technique of fascial sling suspension is quite similar to that described in Chapter 31. Three primary differences exist: (1) A smaller segment of fascia is used with Prolene sutures attached to allow suspension; (2) the technique of transfer and fixation of the suspension sutures makes use of the Raz suture carrier in a fashion identical to that used for bladder neck suspension and modified vaginal sling; and (3) the fascial strip is fastened at the level of the bladder neck by creating a tunnel in the anterior vaginal wall and using additional fixation sutures to avoid migration of the strip.

### SURGICAL TECHNIQUE

The patient is placed in the dorsal lithotomy position and prepared from the abdomen to the perineum (including the vagina). The labia are retracted laterally with stay sutures, and a suprapubic catheter is placed (as described in the section on anterior vaginal wall slings). A urethral Foley catheter is inserted, the bladder is drained, and a weighted speculum is placed. The anterior vaginal wall is infiltrated with saline solution, and two parallel oblique incisions are made. Lateral dissection is carried out over the urethropelvic fascia. The retropubic space is entered bilaterally by advancing curved Mayo scissors toward the ipsilateral shoulder. The retropubic space is freed from adhesions, and the surgeon's fingertip is advanced toward the suprapubic area. At this point a right-angle clamp is used to connect the two vaginal incisions at the level of the bladder neck; this maneuver creates a tunnel (Fig. 34–1). Later in the procedure the harvested fascial strip will be placed within this tunnel, ensuring its fixation and correct location. Of note, if an anterior vaginal flap has been devel-

**Figure 34-1** The anterior vaginal wall "tunnel." This is used as the site of placement of the fascial sling.

**Figure 34-2** The rectus fascial strip.

oped as the "bed" for the strip, absorbable sutures will be needed to fix the fascia in the correct location.

A vaginal pack is now introduced to tamponade any bleeding, and attention is turned to the harvesting of the fascial strip. A number of different donor sites may be used; we prefer to use the rectus fascia.

A 5-cm incision is made in the suprapubic area, and dissection is carried down to the level of the rectus fascia. A 2- × 5-cm rectangle of fascia is harvested and the rectus is subsequently repaired with sutures of polyglycolic acid (Fig. 34–2). The suprapubic incision is next closed. At this point four sutures of No. 1 Prolene are placed in the harvested fascial strip; one suture is placed in each corner of the graft (Fig. 34–3). The fascial strip is placed in the anterior vaginal tunnel and adjusted to ensure correct orientation (Fig. 34–4). A suprapubic puncture is made, and the Raz suture carrier is passed under fingertip control to the vaginal incision. Next, the sutures are passed anteriorly (Figs. 34–5 and 34–6). During this portion of the procedure it is important that the surgeon be aware of the location and orientation of the fascial segment within its tunnel.

Cystoscopy is performed after administration of indigo carmine. The examination should ensure patency of the ureters (blue efflux from both orifices); also, coaptation of bladder neck with traction on the untied sutures should be appreciated. Finally, the examination should ensure that the Prolene sutures do not violate the bladder wall and that the suprapubic catheter is in a good position.

The wounds are irrigated with dilute Betadine, and the vaginal incisions are closed with a running interlocking 2–0 Vicryl suture. During this portion of the closure the rectus fascial strip should be incorporated in the running suture to prevent its migration and ensure proper positioning. A sulfa- or Betadine-impregnated vaginal pack is next introduced. The untied Prolene sutures exiting the suprapubic incision are now tied sequentially to themselves and to their ipsilateral mates. It is important to tie these sutures without tension. At this point the suprapubic puncture is closed. A schematic diagram of the final repair is shown in Figure 34–7.

**Figure 34-4** Insertion of the fascial strip into the anterior vaginal wall tunnel.

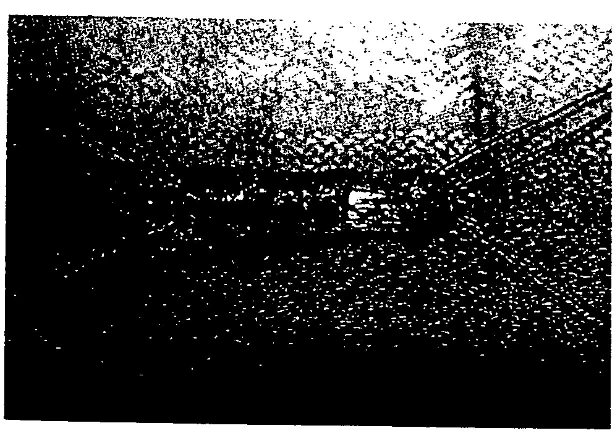


**Figure 34-3** The rectus fascial strip with one No. 1 Prolene suture in each corner.

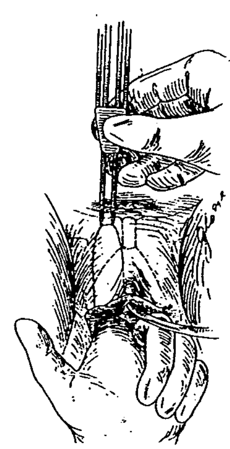


**Figure 34-5** Drawing of passage of the Raz suture carrier.

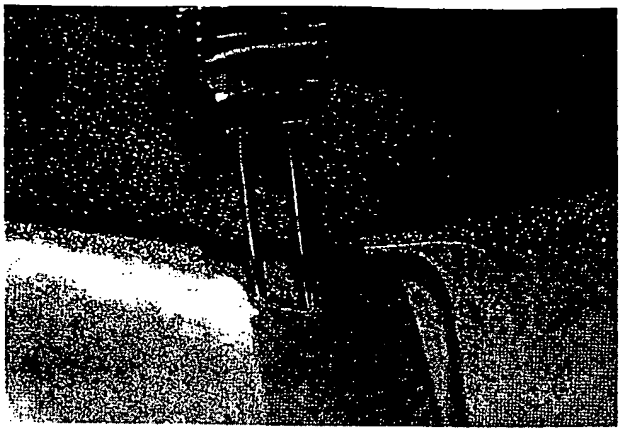


Figure 34-6 Intraoperative photo of passage of the Raz suture carrier.

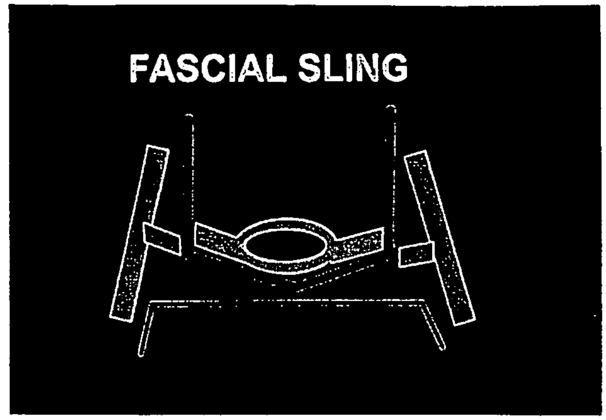



Figure 34-7 Schematic diagram of the fascial sling.

Postoperatively, the Foley catheter and vaginal pack are removed when the patient awakens from anesthesia. The patient is allowed to eat and ambulate when alert and oriented. Discharge usually occurs on the first postoperative day. The patient uses the suprapubic tube for postvoid residual urine checks until the residual is less than 2 ounces; if residual urine remains large for more than 2 to 4 weeks, the patient is instructed in the technique of intermittent straight catheterization. Patients are generally discharged on an oral antibiotic and a mild analgesic.

Karram and Bhatia described a similar technique in their paper on patch procedure using fascia lata.[1] In their procedure a midline vaginal incision was made, and the fascia lata was secured to the suburethra and bladder base using Dexon sutures. An additional difference was their use of only one No. 1 Prolene suture at each side of the strip. This suture was applied to the fascia lata by taking at least four bites in a helical fashion. They described 10 patients treated with this technique; 9 were continent at follow up 1 to 2 years later.

As stated in the introduction to this chapter, this procedure is presented as an optional technique when a fascial sling is thought to be indicated. Because of its basic conformity to other techniques of fascial sling, we would expect results similar to those reported by McGuire[4] and by Blaivas and colleagues (i.e., 90% or greater success).[2]

Postoperative complications are described elsewhere in this book. The surgeon should be aware of the 5% risk of permanent urinary retention associated with fascial sling procedures.[3] Postoperative incontinence may be secondary to inadequate urethral coaptation or detrusor instability.

## REFERENCES


1. Karram MM, Bhatia NN: Patch procedure: Modified transvaginal fascia lata sling for recurrent or severe stress urinary incontinence. OB Gynecol 75(3):461, 1906.
2. Blaivas JG, Jacobs BZ: Pubovaginal sling; Long-term results and prognostic indicators. J Urol 149:313, 1993.
3. Raz S, Siegel AL, Short J: Vaginal wall sling. J Urol 139:727, 1989.
4. McGuire EJ Lytton B: Pubovaginal sling procedure for stress incontinence. J Urol 119:82, 1978.


## BIBLIOGRAPHY


Blaivas JG, Olsson CA: Stress incontinence: Classification and surgical approach. J Urol 139:727, 1988.

Juma S, Little N, Raz S: Vaginal wall sling; four years later. Urology 36:424, 1992.

Leach GE: Vaginal surgery for the urologist. Urol Clin North Am 2(1):61, 1994.

Raz S: Atlas of Transvaginal Surgery. Philadelphia, WB Saunders, 1992.

Smith JL: Fascia lata paraurethral suspension for the correction of stress urinary incontinence. Am J Obstet Gynecol 95:714–721, 1966.

CHAPTER 35

# Anterior Vaginal Wall Sling

Lynn Stothers, M.D., M.H.Sc., F.R.C.S.C.
Shlomo Raz, M.D.
Ashok Chopra, M.D.

The diagnosis of intrinsic sphincter dysfunction (ISD) is based on a combination of factors including history, physical examination, voiding cystourethrogram, and urodynamic parameters. Unlike anatomic incontinence, ISD exists when the bladder neck and proximal urethra are open at rest in the absence of detrusor contractions. This has been called type III incontinence by Blaivas and McGuire.[1] However, the urethra may be radiologically closed in some patients who present clinically with ISD. Whether the urethra is open or closed at rest, the abdominal leak-point pressure is typically low in patients with ISD. The cause of ISD may be multifactorial; possible etiologic factors are damage to the sphincter mechanism from multiple prior surgeries, radiation, direct trauma, or neurologic dysfunction. The diagnosis is made by a combination of historical, physical, and urodynamic parameters because no pathognomonic test currently exists.

Management options for patients with ISD include injection agents (collagen, autologous fat), various sling techniques, or insertion of an artificial urinary sphincter. As a basic principle, a sling can be created by the use of autologous fascial strips (rectus fascia, fascia lata, and so on) or synthetic materials (Marlex), by burying the vaginal mucosa, or by using permanent sutures placed in the periurethral supporting structures. The last technique, known as the anterior vaginal wall sling, is a relatively new technique developed since 1992. It creates a sling without burying the vaginal epithelium or using autologous fascial strips. The techniques for inserting an artificial urinary sphincter and periurethral injectable agents are described elsewhere in this text. This chapter focuses on the surgical technique of making anterior vaginal wall sling using permanent suture material to create a hammock of support from the anatomic structures adjacent to the bladder neck and urethra.

The factors that led to the development of the anterior vaginal wall sling included (1) the need to correct a defect of midurethral support, (2) a better understanding of the anatomy of the levator musculature as it envelops the urethra just distal to the pubourethral ligaments, and (3) evidence suggesting that the bladder neck is not the only mechanism controlling urinary continence. Examples supporting this latter principle include the observations that 30 to 50% of postmenopausal women have an open bladder neck on a straining cystourethrogram with no incontinence and the observation that Y-V plasty does not produce stress incontinence. Most bladder neck suspension procedures elevate the bladder neck, creating a valvular effect, but do not affect the most important area of continence, the midurethral area. The Raz anterior vaginal wall sling involves construction of a sling from the anterior vaginal wall and underlying fascia that provides both compression and support for the urethra.

## Surgical Technique

The surgical goals of the anterior vaginal wall sling are (1) to provide elastic support to the urethra and (2) to create a strong hammock of vaginal wall and underlying tissues that provide a backboard to increase coaptation and support to the midurethra and bladder neck.

**TECHNIQUE** The patient is placed in the lithotomy position, with the heels padded in protective boots and suspended from the supporting stirrups. The vagina and lower abdomen are prepared with an iodine scrub, which extends inferiorly from the level of the umbilicus and includes the entire perineum. The vagina should be scrubbed with iodine-based

soap and painted with an iodine-prep solution. A weighted vaginal speculum and silk labial retraction sutures are used for exposure as in the bladder neck suspension procedure. A suprapubic tube is placed using the curved Lowsley retractor. A 16 Fr Foley catheter is typically used for the suprapubic tube, which should be placed approximately 2 cm above the symphysis pubis in the midline. The incision for the suprapubic tube should be just the width of the catheter and is made using a stab with a knife blade over the tip of the curved Lowsley retractor held by the assistant. Once the suprapubic tube is in position, it is placed on slight traction and the bladder is emptied. A second Foley catheter is placed in the urethra.

Following saline infiltration of the anterior vaginal wall tissues to facilitate dissection, two longitudinal incisions are made in the anterior vaginal wall (Fig. 35–1). These incisions extend from the level of the midurethra to beyond the level of the bladder neck and are 1 cm medial to the folded margin of the anterior vaginal wall throughout their entire length. If the incisions are made too lateral it will be difficult to close them owing to the natural folding of the anterior vaginal wall. Incisions made too medially result in difficult dissection and a greater potential for entering the bladder during dissection.

After the incisions have been made the dissection is carried out over the glistening surface of the periurethral fascia using the Metzenbaum scissors. The attachment of the urethropelvic fascia to the tendinous arch of the obturator is identified. Using the curved Mayo scissors, the retropubic space is entered at the level of the tendinous arch, and the urethropelvic ligament is exposed (Fig. 35–2). Any adhesions encountered in the retropubic space are divided using

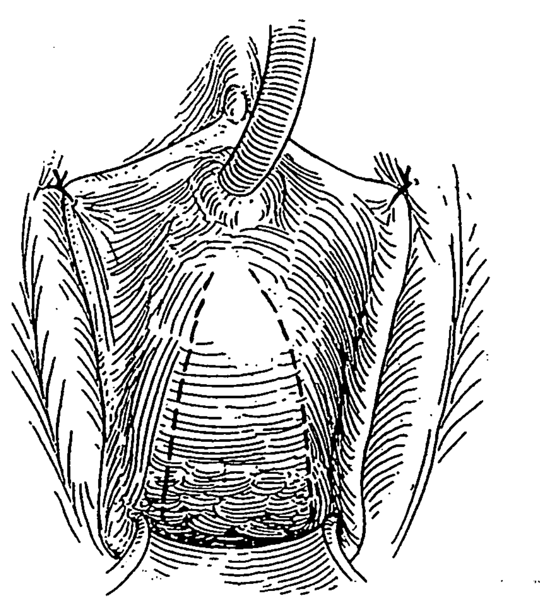


**Figure 35–1** The anterior vaginal wall sling is approached through two lateral incisions in the anterior vaginal wall. A urethral Foley catheter and a suprapubic catheter are placed before these incisions are made. Allis clamps are used on the anterior vaginal wall to aid in exposure.

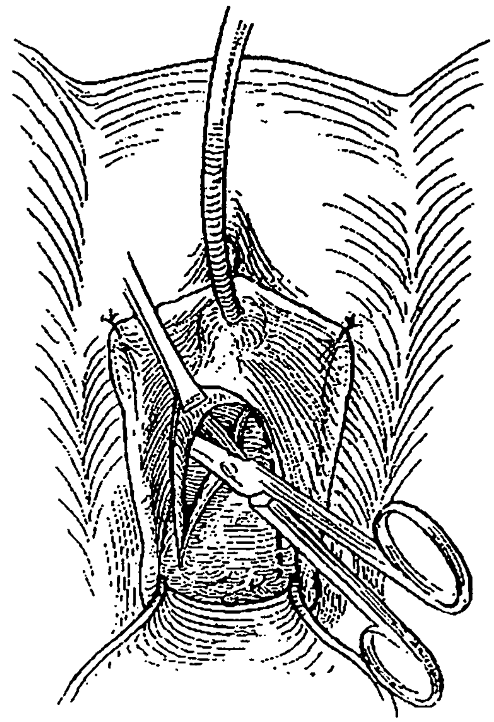


**Figure 35–2** Dissection is carried out over the glistening periurethral fascia. The curved Mayo scissors are shown entering the retropubic space. The scissors are pointed toward the shoulder of the patient. Misdirecting the scissors too far medially could result in perforation of the bladder.

a combination of blunt and sharp dissection. Sutures found in the retropubic space from previous suspension procedures are divided. Adequate urethrolysis should permit a finger entering the retropubic space from either incision to palpate the pubic bone.

Two pairs of No. 1 Prolene sutures are placed during creation of the anterior vaginal wall sling. The first pair of Prolene sutures is placed at the level of the bladder neck. Each suture includes helical bites of the vesicopelvic fascia, the urethropelvic ligament, and the anterior vaginal wall without epithelium (Fig. 35–3). The arc of the needle should include a large area of tissue in both the vesicopelvic fascia and the urethropelvic ligament. When passing the needle to encompass the vesicopelvic fascia, the direction of the needle should be kept parallel to the vaginal wall. Failure to keep the needle parallel to the vaginal wall may result in suture material's entering the bladder.

To pass the second pair of Prolene sutures, the forceps are opened in the retropubic space. Gentle downward traction with the open forceps aids in exposure of the levator musculature. The second pair of Prolene sutures includes the levator ani musculature as it inserts onto the midurethral segment, the medial edge of the urethropelvic ligament, and the anterior vaginal wall without epithelium (Fig. 35–4). To obtain an adequate amount of levator tissue the needle must be placed deep into the retropubic space. The levator should be visualized on the arc of the needle. When the anterior vaginal wall without epithelium is taken, the arc of the needle should not

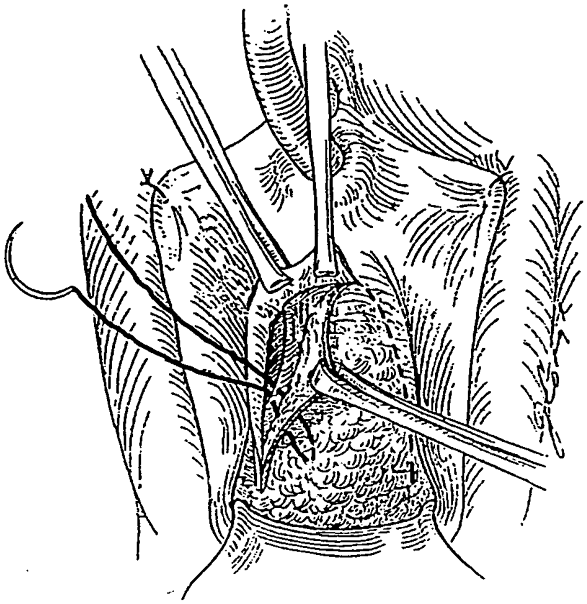
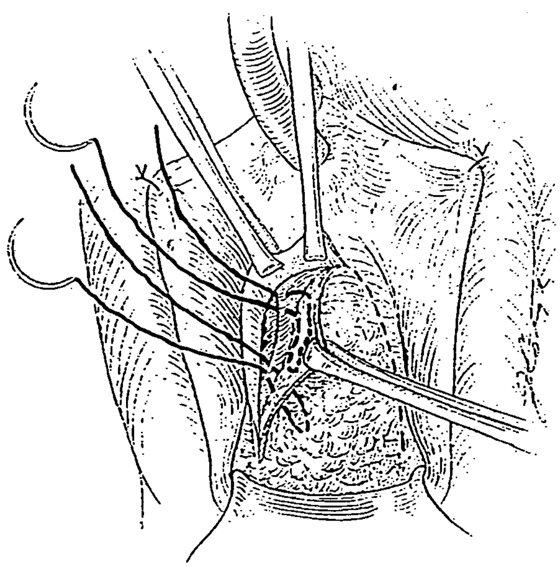


**Figure 35–3** The first pair of Prolene sutures placed at the level of the bladder neck is shown. These sutures include the vesicopelvic fascia, the urethropelvic ligament, and the anterior vaginal wall without epithelium.

cross the midline but should include a generous amount of tissue. As with the vesicopelvic fascia, when the needle is passed to include the anterior vaginal wall without epithelium, the arc of the needle should stay parallel to the anterior vaginal wall to avoid entering the spongy tissue of the urethra itself.

After the four Prolene sutures are in place, a rectangle of support for the bladder neck and urethra can be visualized (Fig. 35–5). To transfer the Prolene sutures, a stab incision in the lower abdomen is made just anterior to the symphysis pubis in the midline.



**igure 35–4** The second pair of Prolene sutures is placed at the level of the midurethra. These sutures include the levator musculature, the edge of the urethropelvic ligament, and the anterior vaginal wall without epithelium.

**Figure 35–5** Intraoperative photograph after placement of the four Prolene sutures before they are transferred through the lower abdominal stab incision. They demonstrate the complete rectangle of vaginal wall, which will provide a backboard of support for the urethra and bladder neck during increases in abdominal pressure.

Blunt dissection with a clamp facilitates exposure of the rectus fascia. A double-pronged needle is passed, scratching the symphysis into the retropubic space and onto the operator's finger, which is placed in the retropubic space through the vaginal incision. Under fingertip control, the needle is advanced through the ipsilateral vaginal incision, and the ends of the Prolene suture are passed through the eyes of the needle. The suture is then transferred to the lower abdomen by pulling up on the needle. After all four Prolene sutures have been transferred through the single lower abdominal stab incision, the urethral catheter is temporarily removed to allow cystoscopy.

Just prior to cystoscopy, indigo carmine is administered, and blue efflux should be noted from both ureteral orifices. The location of the suprapubic catheter is noted, and the side walls of the bladder and trigone are inspected to ensure that no suture has passed within the bladder. The urethral Foley catheter is then replaced, and the anterior vaginal wall incisions are closed using a running locking 2–0 polyglycolic acid suture. A vaginal pack covered with sulfa cream is placed, and the suspension sutures are tied down without undue tension following placement of the vaginal pack. Each suture is tied to itself and its neighbor for security. The skin edges are loosened with a clamp to prevent dimpling of the skin over the Prolene sutures. The suprapubic stab wound is closed with a subcuticular 4–0 absorbable suture, and Steri-Strips are applied. Both the suprapubic tube and the urethral catheter are placed to straight drainage.

**POSTOPERATIVE CARE** This procedure is currently performed as outpatient surgery. Within 6 to 20 hours

postoperatively the patient is prepared for discharge. The vaginal pack and urethral catheter are removed, and the suprapubic tube is plugged. The patient should maintain the suprapubic tube taped on slight traction to prevent leakage around the tube. The patient is asked to try to void through the urethra and to check her own postvoid residual urine after each voiding. Oral antibiotics, stool softeners, and oral analgesics are given to the patient for use after discharge. Antibiotics are continued while the suprapubic tube is in place. The urethral catheter is removed once the postvoid residual urine is consistently less than 2 ounces.

## Results

One hundred and thirty-seven women underwent the sling procedure between June of 1992 and June of 1994.[2] Preoperative evaluation included history, physical examination, urinalysis, lateral cystography, videourodynamics, cystoscopy, quality of life measures, and SEAPI incontinence classification (S, activity-related incontinence; E, emptying ability; A, degree of anatomic defect; P, use of protection, and I, instability). Postoperative outcome measures were prospectively assigned on a 6-month basis by a third party and included SEAPI score, quality of life scores, and assessment of any complications.[3] Statistics were applied using SPSS* computer software to create regression models for outcome variables of interest.

The median follow-up has been 11 months (range, 3 to 24 months) in the 137 patients. Age ranged from 32 to 81 years. Three patients were lost to follow-up. Of the 134 patients who could be evaluated, 91 had ISD, and 42 had anatomic incontinence (AI). Overall, 54% of patients had undergone an average of 2.5 prior procedures for stress incontinence. Associated urge incontinence was common preoperatively and was seen clinically in 47% of these patients. One hundred and twenty-nine patients were considered cured at last follow-up; they had clinical SEAPI scores of S0-1, E0, A0, P0-1. Five of 134 patients were considered failures; they had recurrent incontinence on follow-up that was unrelated to instability and required further therapy. Time to failure in ISD and AI patients was modeled using Kaplan Meier survival curves, and the logrank test showed no significant difference between these two groups ($p >$ .05). Conditional logistic regression covariates revealed no significant predictive factors for postoperative failure. Seven percent of patients developed de novo instability and were treated with anticholinergics orally. Three percent had SEAPI inhibition scores $\geq I_2$ prior to anticholinergic therapy. Preoperative patient age was the only predictive factor of de novo instability identified by the logistic regression model ($p < .05$). Preoperative and postoperative within-patient changes of quality of life scores were statistically and significantly different for patients with AI and ISD.

CONCLUSION These initial results indicate that excellent continence was achieved in patients with both ISD and AI using the anterior vaginal wall sling. Advantages of this surgical technique include the absence of vaginal flaps and the lack of a transverse incision over the urethra as used in other techniques. No vaginal tissue is buried. Other advantages of this technique are its simplicity, avoidance of laparotomy, short hospital stay, lateral placement of permanent nonreactive sutures, and the ability to correct mild cystocele. The technique relies on healthy well-vascularized supporting tissues.

Further follow-up is required to establish the longevity of these results; however, the procedure has been shown to be safe and effective in short-term follow-up and allows outpatient surgical management of both ISD and AI.

*SPSS is a registered trademark of SPSS Inc., 444 North Michigan Avenue, Chicago, IL

## REFERENCES

1. Blaivas JG, Olsson CA: Stress incontinence: Classification and surgical approach. J Urol 139:727, 1988.
2. Stothers L, Chopra A, Raz S: Vaginal wall sling for anatomic incontinence and intrinsic sphincter damage—efficacy and outcome analysis. J Urol 153:525A, 1995.
3. Raz S, Erickson DR: SEAPI QMM Incontinence Classification System. Neurourol Urodynam 11:187, 1992.

CHAPTER 41

# Why Anti-incontinence Surgery Succeeds or Fails

David F. Penson, M.D.
Shlomo Raz, M.D.

The overall goal of any surgery for stress urinary incontinence (SUI) is to correct the anatomic and functional abnormalities of the bladder neck or urethra and to re-create conditions conducive to an effective continence mechanism. To this end, more than 100 different procedures designed to treat SUI have been described in the literature.[1] Since the first description of the Kelly plication in 1918,[2] our surgical techniques have evolved and improved as our understanding of the female anatomy and the continence mechanism has grown. There is still, however, a 5 to 15% failure rate, defined as persistent SUI, recurrent SUI, de novo detrusor instability (DI), obstructive or irritative voiding symptoms, urinary retention, or persistent postoperative pain, associated with these operations.[3-5] In this chapter, we examine the facets of a successful anti-incontinence operation and discuss how and why these procedures fail.

## Mechanisms of Continence

In women, an effective urinary continence mechanism depends on a complex interaction among four factors: effective urethral closing pressure, functional urethral length, anatomic support of the bladder outlet (urethrotrigonal anatomy), and urethral and pelvic floor compensation for increased intra-abdominal pressure.

The first factor, effective urethral closing pressure, is defined as a urethral pressure that exceeds intravesical pressure, thereby preventing the flow of urine into and through the urethra. This pressure depends on a number of components, including complete urethral coaptation and tensile forces provided by the urethropelvic ligaments and levator musculature. The healthy, infolding urethral mucosa and rich submucosal vascular plexus create an effective mucosal sphincter similar to the washer of a faucet. In addition, mucous secretions contribute to the development of surface tension that further promotes complete urethral coaptation.[6] Effective urethral closing pressure is increased further by tensile forces provided by a two-layered condensation of the levator ani fascia that we call the urethropelvic ligaments. These ligaments enclose the urethra and provide compression for the proximal and midurethra (Fig. 41-1). These structures are essential in providing support for the mechanism of passive continence and also during periods of increased intra-abdominal stress. Furthermore, voluntary or reflex contractions of the levator ani or obturator musculature increase the tensile forces exerted by these ligaments and increase bladder outlet resistance.

The second factor, functional urethral length, is

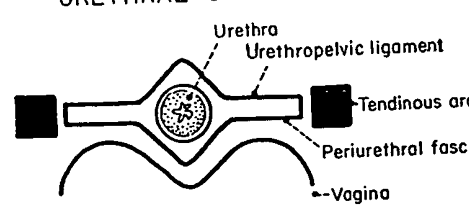



**Figure 41-1** The periurethral fascia and levator ani fascia form an envelope around the urethra and are collectively termed the urethropelvic ligaments. These structures provide elastic support for the passive mechanism of continence. Furthermore, they contract during periods of increased intra-abdominal pressure and increase coaptation of the urethral wall. (Adapted from Raz S, Little NA, Juma S: Female urology. *In* Walsh PC, Retik AB, Stamey TA, Vaughan ED Jr [eds]: Campbell's Urology, 6th ed. Philadelphia, WB Saunders, 1992, pp 2782–2827.)

defined as the total length of urethra in which urethral pressure exceeds bladder pressure as measured by the urethral pressure profile. This definition is critically different from that for anatomic urethral length, which is the length of urethra from the internal to the external urethral meatus. The anatomic length of the urethra is approximately 3 to 4 cm, but the functional length is only 2.8 cm.[7] Although the importance of adequate urethral length may seem obvious, the overall contribution of functional urethral length to the mechanism of continence may be less than expected. This statement is based on the following evidence. First, many patients with shortened urethral lengths are continent.[8] Second, isolated resection of the distal third of the urethra for treatment of malignancy does not necessarily result in incontinence.[9] This implies that the distal third of the urethra serves only as a conduit for urine. Third, Y-V plasty or incision of the bladder neck does not result in incontinence in otherwise well-supported bladders.[6] Removal of the bladder neck and midurethral area together, however, will result in incontinence.[10] Although the bladder neck does provide continence, its removal or destruction does not result in incontinence because the middle third of the urethra acts as a secondary continence zone. This suggests that a certain minimal length in the midurethra is critical to the continence mechanism. Henriksson and Ulmsten showed that most patients with SUI showed little change in functional urethral length or maximal closure pressure following successful bladder neck suspension.[11] On a urethral stress profile, however, improvements in maximal closure pressure and functional urethral length were noted.[11] This indicates that the role of functional urethral length may be to provide continence in the presence of increased intra-abdominal stress.

The third factor, anatomic support of the bladder outlet, has been well described elsewhere in this book and in the literature.[5,6,12,13] In the standing position, the bladder base is maintained in the horizontal position above the level of the inferior ramus of the symphysis. When hypermobility and descent of the bladder neck are present, SUI is often noted. The internal urethral orifice is normally supported in a fixed retropubic "nondependent" position with regard to the bladder base (Fig. 41–2). This creates a valvar effect in the bladder neck.[5] This valvar effect is of particular importance in the presence of increased intra-abdominal pressure because it allows "through transmission" of this pressure to the bladder base and prevents leakage of urine through the urethra. In addition, on coughing or straining, continence is improved by further posterior rotation of the bladder, which can also lead to urethral closure.

Recent reports have indicated the importance of proper support of the midurethral complex in maintaining both passive continence and continence in the presence of increased intra-abdominal pressures.[14] We believe that the midurethral complex may play a greater role in the continence mechanism than was previously thought and that anti-incontinence surgery should be performed with this in mind.

The fourth factor, pelvic floor muscular activity in response to stress, also plays an important role in maintaining continence. When faced with a sudden increase in intra-abdominal pressure, a reflex contraction of the muscle fibers of the levator ani and obturator groups and of the urogenital diaphragm occurs in neurologically intact women that results in

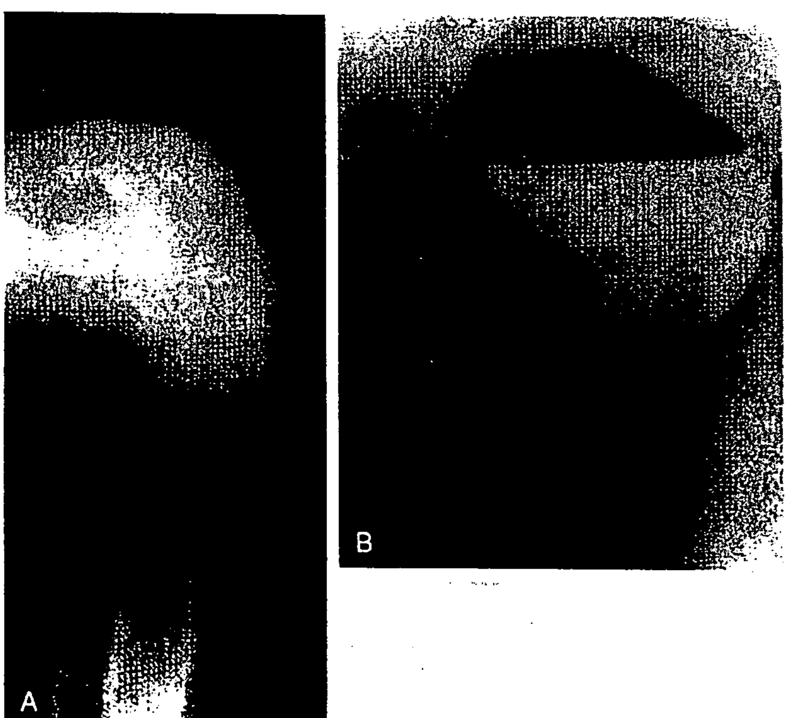



**Figure 41-2** Straining cystourethrograms in normal and incontinent patients. In the normal patient *(A)*, note that the internal urethral orifice is fixed in a retropubic "nondependent" position. This allows pressure to be directed at the bladder base and creates a valvar effect. In the incontinent patient *(B)*, the internal urethral orifice is in a dependent position. This creates funneling at the bladder neck and leads to leakage of urine with straining. (From Smith RB, Ehrlich RM: Complications of Urologic Surgery, 2nd ed. Philadelphia, WB Saunders, 1990.)

closure at the level of the midurethra and increased elastic tension on the urethropelvic ligaments. This in turn leads to stabilization of the bladder neck and increased closure of the proximal urethra. In a properly supported bladder, the contracted pelvic floor acts as a "backboard," providing a stable surface for urethral compression.[6] The pelvic floor muscles also contribute to the continence mechanism through voluntary contraction, which allows the woman to voluntarily stop the urinary stream or to prevent urinary escape. Finally, the pelvic floor muscles contribute to the mechanism of continence through their basic underlying tone, like any other skeletal muscle. These muscles provide support mainly to the middle third of the urethra and are probably responsible for 30 to 50% of the closing pressure in this area.[15] This point is demonstrated when the effect of spinal anesthesia on the muscles of the pelvic floor is examined. In men, if one performs transurethral resection of the prostate (TURP) under spinal anesthesia and fills the bladder, the application of pressure to the suprapubic area leads to the leakage of urine. In the awake patient or the patient under general anesthesia without muscle relaxation, pressure on the suprapubic area does not lead to incontinence. This is true in males and females. This example illustrates the contribution of the pelvic floor musculature to the continence mechanism. The contribution of proper pelvic floor repair to the long-term outcome of antistress incontinence interventions cannot be overstated. If the patient is left with a weak pelvic floor, proper transmission of increased intravesical pressures will not occur, and less efficient urethral closure and recurrent stress urinary incontinence will ensue.

## Characteristics of a Successful Anti-incontinence Operation

As mentioned earlier, most procedures designed to treat SUI attempt to restore the anatomy of the bladder neck and urethra to a position that is conducive to continence. This in turn affects the urethral function of the patient and allows transmission of increased intra-abdominal stress to areas away from the urethrovesical junction.[1] Most anti-incontinence procedures, including the Marshall-Marchetti-Krantz (MMK) procedure, the Burch colposuspension, the anterior repair procedure, and transvaginal procedures such as needle suspensions (Raz, Stamey, Gittes), attempt to elevate the bladder neck above the lowest level of the bladder base. These procedures direct any increased pressure away from the previously dependent bladder neck to the lowest point at the bladder base, creating a valvar effect at the bladder neck and preventing the leakage of urine. It is important to note that this is a dynamic effect and is active only during periods of increased intra-abdominal and intra-pelvic pressures. We can see this valvar effect in action from the fact that stress urinary incontinence can be reproduced in more than 50% of patients following successful surgery to realign the urethrovesical junction.[4] Following a successful bladder neck suspension, elevation of the bladder base in the patient with a full bladder can lead to recurrent SUI. This occurs because the bladder neck becomes the most dependent position, and the valvar effect is therefore negated. This result confirms the fact that the major mechanism of continence in surgical procedures that elevate the bladder neck is a valvar effect. It is also important to note that the valvar effect is not obstructive in nature. In general, anti-incontinence operations do not work by causing obstruction.

The MMK procedure, the Burch colposuspension, the Raz four-corner bladder neck suspension, and most sling procedures, including the vaginal wall sling procedure that we have described elsewhere,[14] move the dependent bladder neck, trigone, and proximal urethra to a position behind the symphysis. Sling procedures, such as the vaginal wall and fascia sling, not only change the anatomic position but also create a "backboard" for the urethra. Thus, any increased intra-abdominal forces cause increased compression of the proximal urethra. This backboard effect ensures that intraurethral pressure is higher than intravesical pressures and therefore provides continence in the presence of increased intra-abdominal pressure. In effect, these operations provide a stable and strong "hammock" of urethral support (Fig. 41–3). Any changes in intra-abdominal pressure compress the urethra against this support and ensure continence.

Although the importance of the anatomic effects of these operations is without question, our experience with these procedures has led us to believe that restoration of normal anatomy is not always sufficient to produce continence. It is our belief that all patients who suffer from SUI have some degree of intrinsic sphincter dysfunction (ISD). It has been our experience using fluoroscopy that 30 to 50% of continent women have open bladder necks while straining and in the standing position. This fact implies that there are many women with anatomic abnormalities who do not suffer from SUI. There must, therefore, be a

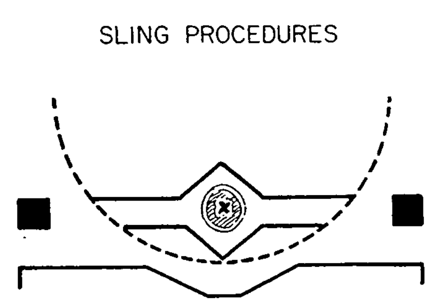



**Figure 41-3** Schematic diagram of the effect of sling procedures. These operations provide stable elastic support for the urethra and create a "hammock" to improve coaptation. (From Raz S, Little NA, Juma S: Female urology. *In* Walsh PC, Retik AB, Stamey TA, Vaughn ED Jr [eds]: Campbell's Urology, 6th ed. Philadelphia, WB Saunders, 1992, pp 2782–2827.)

component of ISD in every patient with anatomic incontinence. It is important that the clinician bear in mind that SUI cannot be explained on the basis of anatomic changes alone. There are many patients, particularly among the elderly population, who suffer from incontinence but still have normal anatomy, including a well-supported urethra.

Anatomic changes are related to several factors including hysterectomy, childbirth, hormonal changes, and aging. The anatomic changes associated with SUI are often a result of childbirth. It is widely accepted that multiparous women are more likely to suffer SUI than nulliparous women.[5] If this is the case, why do most women who suffer from SUI first become symptomatic in their fifties and sixties, many years after childbirth and usually after the onset of menopause? Estrogen deficiency associated with menopause has been shown to affect urethral function by causing atrophy of the urethral seal, leading to a compromise in the coaptability of the urethra.[6,16–19] In addition, the lack of estrogen affects anatomic support by worsening an already poor situation, causing weakness and loss of elasticity in the urethropelvic and pubourethral ligaments. All of this information again implies that some element of ISD must be present in this patient population; otherwise, they would all be incontinent immediately after childbirth when the anatomic changes described elsewhere in this book occur.

Our belief that all women who suffer from SUI have some degree of ISD has led us to support the use of the vaginal wall sling procedure for most cases of SUI. We have based this conclusion on several facts: (1) The most important segment of urethra needed for compensation against an increase in abdominal pressure is not the bladder neck. We know this from the fact that the bladder neck is often found to be open in continent women, as mentioned earlier. (2) During bladder neck suspension procedures we reposition the bladder neck in a more superior position. In so doing, we increase the valvar effect without truly affecting urethral function, thereby recreating continence in an indirect way. (3) Most discussions about the causes of SUI seem to center on bladder neck hypermobility, yet most patients suffer from a second anatomic defect, the separation of the urethra from the inferior ramus of the symphysis pubis. The increased distance between these two structures is due to a weakness of the midurethral complex (levator muscle and pubourethral ligaments). Very few surgical procedures affect this segment of the urethra. Our vaginal wall sling procedure is an attempt to modify midurethral function. In our sling we not only elevate the bladder neck but also provide support, elevation, and increased resistance in the midurethral area, which, in our view, is the most important compensatory or secondary area of continence. It is this attention to the midurethral complex that clearly distinguishes our vaginal wall sling from other sling procedures, including those that use rectus fascia, fascia lata, and synthetic materials such as Marlex or Gore-Tex.

## Why Do Anti-incontinence Operations Fail?

The goal of surgery for anatomic SUI is to reposition and support the bladder base. The goal of surgery for ISD is to provide compression and coaptation to the failed sphincteric unit. Failure of anti-incontinence surgery of either type is defined as persistent SUI, recurrent SUI, de novo detrusor instability, obstructive or irritative voiding symptoms, urinary retention, or persistent postoperative pain. These failures can occur regardless of whether the goal of the operation is achieved. The causes of failure to correct stress incontinence can be categorized into four groups: anatomic failures in general due to technical reasons (e.g., the bladder neck was not properly supported); functional failures (the bladder was properly supported but nevertheless incontinence exists); inappropriate patient selection; and failures due to postoperative complications.

### ANATOMIC FAILURES DUE TO TECHNICAL REASONS

In technical failures resulting in poor anatomic support (recurrent anatomic defect), the defect was never corrected or it recurred after a period of good support. Misplacement of the suspension sutures (not at the bladder neck) can lead to symptomatic failure secondary to recurrent anatomic defect. Placement of the sutures too far distal to the bladder neck (well below the level of the urethrovesical junction or the midurethra) may result in obstructive symptoms secondary to urethral kinking. Even if the patient does not complain of obstructive symptoms, placement of the suspension sutures in this position may result in inadequate elevation of the proximal urethra and bladder neck. Although the patient may report some relief, any remaining SUI is a result of insufficient elevation of the bladder neck due to improper distal placement of the supporting sutures (Fig. 41–4). There is a similar danger in placing the suspension sutures too far laterally, away from the important periurethral tissue. By placing the sutures far away from the urethra, too much lax tissue may be left between the suture and the proximal urethra and bladder neck. This will create a situation similar to the one described previously, in which the patient may report some relief, but SUI will persist despite moderate elevation of the affected anatomy.

Another cause of technical failure is the use of poor vaginal anchoring tissue. In these cases, the sutures are placed in the right place but break from the anchor in the vaginal site. This is the most common

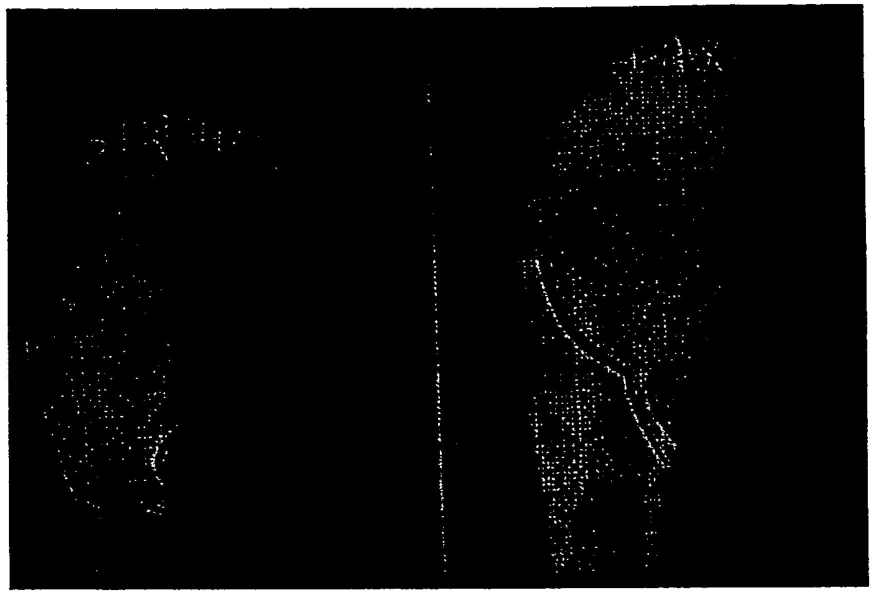


**Figure 41-4** A relaxed and straining cystourethrogram in a patient following a failed bladder neck suspension. Note that there is insufficient elevation of the bladder neck on straining, leading to recurrent incontinence. (From Raz S: Atlas of Transvaginal Surgery. Philadelphia, WB Saunders, 1992.)

cause of failure. This occurs not only because of failure or breakage of the suture material but also because the intact suture pulls through the vaginal anchoring site.[20] This situation is almost always due to the inclusion of poor-quality tissue in constructing the vaginal anchor and leads to recurrence of anatomic abnormalities.

Technical failures can also result from failure of the pubic bone anchor tissue. In the case of the Burch procedure or MMK procedure, a weakened Cooper's ligament or pubic periosteum can lead to the sutures' pulling through and recurrence of anatomic abnormalities. In needle suspension procedures the sutures can pull through the abdominal wall fascia if an inadequate amount of this tissue is used. Finally, in sling procedures, the anchoring tissue used in securing the flap may be inadequate, leading to technical failure. Our experience has proved that use of the periosteum of the symphysis pubis, as in the MMK procedure, is often unreliable to maintain support of the bladder neck and proximal urethra. For this reason, it is preferable to use Cooper's ligament, as described in the Burch colposuspension, when using a suprapubic approach (Fig. 41-5). Bavendam and Leach have described using the pubic tubercle in place of the periosteum in needle suspension procedures.[21]

Another technical reason for surgical failure secondary to recurrent anatomic abnormalities is inappropriate selection of suture material. Numerous authors have supported the use of absorbable suture material, such as Dexon or Maxon, when performing anti-incontinence surgery, such as colpocystourethropexy.[22] We routinely use nonabsorbable suture material when performing these procedures. The use of absorbable suture material introduces the risk that the supporting sutures may dissolve prior to the formation of adequate scar tissue. The bladder neck and proximal urethra may then return to their previous dependent positions, resulting in recurrent SUI. We believe that the use of cystoscopy effectively eliminates the possibility that the sutures could be intravesical and makes nonabsorbable suture material safe. Breakage of the suture material can also lead to recurrence of anatomic abnormalities. This is often caused by early mobilization and overexertion by the patient, leading to increased intra-abdominal stress and breakdown of the repair. Some patients can report the exact instant of failure, when they felt something rip or pop and then suffered recurrent SUI.[23] As a general rule, sutures should not be tied too tightly because this will lead to pain or urethral obstruction and can damage the suture material. At the same time the surgeon must not tie the suture too loosely or the knot might come undone. When

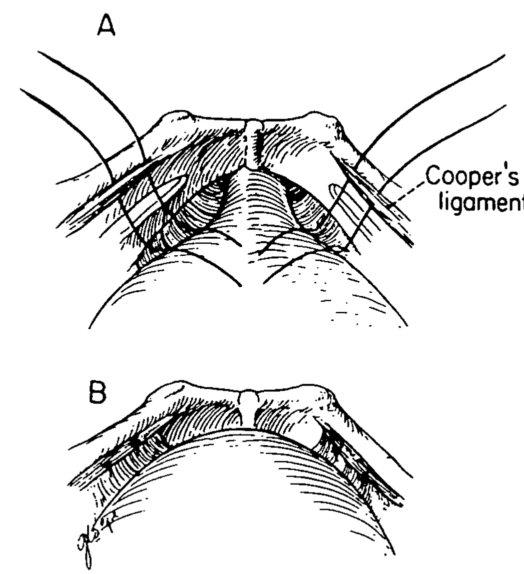



**Figure 41-5** Burch colposuspension. (From Raz S, Little NA, Juma S: Female urology. *In* Walsh PC, Retik AB, Stamey TA, Vaughn ED Jr [eds]: Campbell's Urology, 6th ed. Philadelphia, WB Saunders, 1992, pp 2782–2827.)

placing the knot, the surgeon should bear in mind that the goal of surgery is to gently reposition the bladder neck and to provide stabilization and prevent the urethra from dropping down during periods of increased stress. There is nothing to be gained by placing unnecessary tension on the sutures.

## FUNCTIONAL FAILURES

In functional failures in the presence of restored anatomy, the bladder neck is properly supported but recurrent incontinence occurs nonetheless. There are many reasons for functional failures. One cause of a functional failure is misplacement of the suspension sutures. The importance of proper placement of these sutures in all types of anti-incontinence surgery cannot be overemphasized. We always use intraoperative cystoscopic evaluation of the bladder neck to ensure proper placement of the sutures. Placement of sutures too proximally (above the level of the urethrovesical junction) will fix the bladder neck in the open position and result in worsened or continuous SUI postoperatively. Placement of the sutures too medially (close to the urethra wall itself) can result in an intense scarring reaction and can lead to the formation of a fibrotic "pipestem" urethra (Fig. 41–6). This is the most common form of failure following the MMK procedure. If the surgeon places the sutures too close to the urethral wall, the normal anatomy may be restored, but periurethral fibrosis may occur, resulting in incomplete coaptation of the urethra with subsequent ISD and continued SUI. The urethra must be able to contract properly for the continence mechanism to function correctly. Placement of suture material too close to the urethra can also lead to obstructive voiding symptoms, resulting in failure in this way as well. The urethra must shorten, funnel, and open during voiding. Periurethral fixation as described earlier will impair this function and lead to the symptoms we have just described. The use of intraoperative cystoscopy, after placement of the sutures but prior to tying them down, allows the surgeon to assess their position and ensure that they have not been placed intravesically. In addition, cystoscopy is of great importance when using nonabsorbable suture material because intravesical placement can lead to stone formation, irritative voiding symptoms, and surgical failure. If the surgeon thinks that the sutures have been placed improperly, they should be removed and replaced to ensure a successful outcome.

Failure to lyse adhesions from previous failed procedures is another reason for functional failure in the presence of restored anatomy. In patients who have undergone previous surgery, an intense periurethral fibrosis can occur, particularly if the suspension sutures have been placed immediately adjacent to the urethra, as described previously. If these adhesions are not lysed, the urethra will remain fixed in a dependent position, resulting in continued SUI. We think that it is important for the surgeon to lyse all retropubic adhesions and detach the urethropelvic ligament from its pubic attachments. Failure to do this may prevent optimal restoration of the bladder neck and proximal urethra to a more superior position. With lysing the inferolateral fixation applied by this structure secondary to its insertion on the tendinous arch of the obturator fascia is removed, and the suspension sutures are able to draw the urethra more superiorly, resulting in better postoperative continence.

The presence of persistent SUI in the presence of a well-supported urethra postoperatively is usually indicative of some degree of ISD. This is often secondary to postoperative atrophy of the urethral mucosa and the spongy tissue of the submucosa. ISD leads to inadequate coaptation of the urethra despite good apposition of the muscular layer and is the most common cause of functional failure. One could compare this situation to that of a new faucet with a bad washer. You can apply unlimited pressure, but the faucet will still leak if the washer is faulty and does not create a good seal. If one changes the washer, however, only minimal pressure is required to stop the leak. ISD is the main indication for the use of injectables. They increase the bulk of the inner urethral layer (mucosal sphincter), thereby improving continence.

When a patient presents with persistent incontinence despite restoration of normal anatomy, the surgeon should also consider the possibility of iatrogenic vesicovaginal or urethrovaginal fistula. A voiding cystourethrogram is helpful in confirming this diagnosis.

## INAPPROPRIATE PATIENT SELECTION

The proper selection of patients cannot be stressed enough. A complete history and physical examination, cystography, and cystoscopy can provide the surgeon with invaluable information about the type of SUI that is present and help guide the choice of surgical procedure. The main diagnostic task is to separate stress incontinence due to sphincter incompetence from bladder instability. Often the difference is not clear despite a good history, physical examination, and urodynamic evaluation. A full videourodynamic work-up is particularly helpful in more complicated cases when the initial evaluation is not adequate. The surgeon must determine if the cause of the patient's incontinence stems from anatomic incontinence, ISD, or a combination of these causes. Patients with stress incontinence due to hypermobility of the bladder neck and proximal urethra (anatomic incontinence) can expect an 80 to 90% rate of cure from surgery that restores the bladder neck to a high anatomic position.[5, 20] In a patient who suffers from ISD, however, an operation designed to restore normal anatomy alone is of minimal value.[24] Patients with ISD often have a history of multiple operations, both abdominal and vaginal, resulting in periurethral fibrosis and a pipestem urethra.[3] This patient

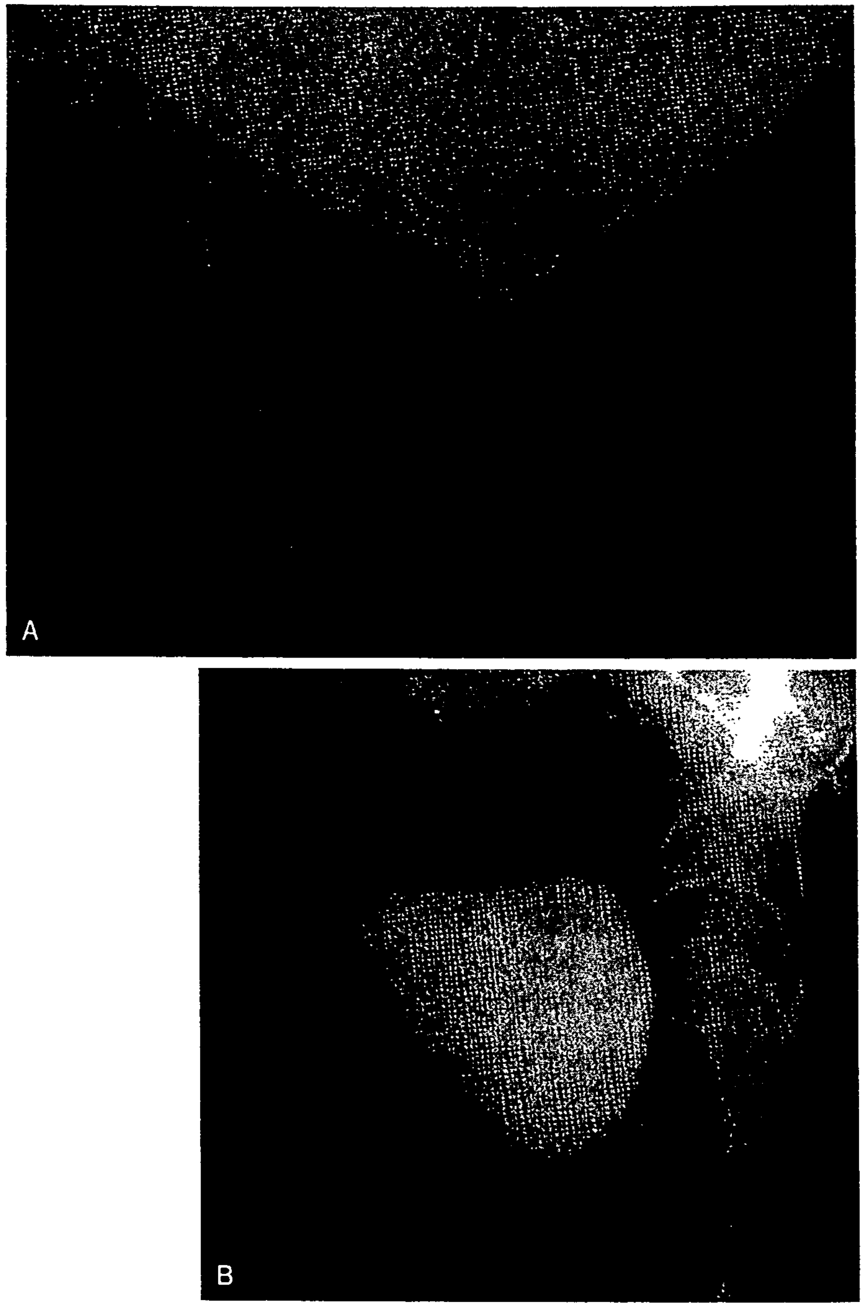



**Figure 41-6** *A* and *B*, Standing cystourethrograms in two patients following multiple failed anti-incontinence procedures. Note that both patients have adequate anatomic support. In both cases, however, the urethra is in a fixed and open position, leading to recurrent severe type III stress incontinence. (*A* from Raz S: Atlas of Transvaginal Surgery. Philadelphia, WB Saunders, 1992; *B* from Smith RB, Ehrlich RM: Complications of Urologic Surgery, 2nd ed. Philadelphia, WB Saunders, 1990.)

population can expect a similar cure rate (95%) with the use of injectables such as collagen or a sling procedure (fascial, Gore-Tex, or vaginal wall).[14] It is therefore inappropriate to perform bladder neck suspension in a patient with isolated ISD.

Patients often present with a combination of symptoms, including frequency and urgency, in addition to genuine stress incontinence. Further evaluation often reveals a wide-open posterior urethra when the patient is in the standing position. This dilatation of the urethra leads to a constant sensation of impending micturition. A complete history usually reveals that the patient's symptoms of urgency and frequency are positional in nature and improve when the patient is supine. Vesicourethral suspension not only cures the patient's SUI but also relieves the patient's symptoms of urgency, frequency, and urge incontinence in at least 50% of cases.[25, 26] In contrast to this is the patient who presents with stress-induced detrusor instability. In these cases, a sudden increase in intra-abdominal pressure will trigger a detrusor contraction, simulating SUI. Urodynamic evaluation allows the surgeon to differentiate between bladder hyperreflexia and anatomic incontinence with associated urgency and frequency. Patients suffering from bladder hyperreflexia predominantly are usually not surgical candidates and will benefit from medical therapy.

There are many other conditions that cause or may be confused with SUI that may lead to improper selection of patients for anti-incontinence surgery. These include urethral diverticula, ureteral ectopia,

and bladder calculi. Furthermore, overflow incontinence secondary to a neurologic deficit can easily be mistaken for SUI, leading to inappropriate intervention and surgical failure. A complete preoperative evaluation, including a thorough history, physical examination, and videourodynamics and cystoscopy, when indicated, will identify these entities and is absolutely essential to determine the true nature of the patient's stress incontinence and to guide the choice of surgical technique.

## POSTOPERATIVE COMPLICATIONS

Finally, anti-incontinence surgery can fail because of postoperative complications resulting in new symptoms such as obstruction or de novo instability. Although these topics are discussed at greater length elsewhere in this book, a few words are indicated here. Postoperative urinary retention is most commonly due to placement of the suspension sutures too far distally or too close to the urethra, resulting in scarring. If the sutures are inadvertently placed intraurethrally, they can result in stone formation and obstruction as well. Obstructive symptoms can also be caused by pelvic hematoma. Most cases are temporary and can be managed by self-intermittent catheterization if a suprapubic catheter is not present. If the problem persists for an extended period of time, reoperation and urethrolysis are indicated and have been shown to produce good results in 71% of cases.[27]

De novo bladder instability is a well-known complication of anti-incontinence surgery. Most often, symptoms were present preoperatively and became more pronounced in the postoperative period. These are often temporary and resolve over time. There are patients who develop new-onset bladder instability causing them to be classed as surgical failures. The cause of this is unclear, and the treatment is medical in nature. In isolated cases, augmentation cystoplasty can be considered.

## REFERENCES


1. Stanton SL: Stress incontinence: Why and how operations work. Clin Obstet Gynecol 12(2):369, 1985.
2. Kelly HA: Incontinence of urine in women. Urol Cutan Rev 17:291, 1918.
3. Raz S, Maggio AL, Kaufman JJ: Why Marshall-Marchetti operation works . . . or does not. Urology 14(2):154, 1979.
4. Stanton SL, Tanagho EA (eds): Surgery of Female Incontinence, 2nd ed. New York, Springer-Verlag, 1986, chaps. 3, 5.
5. Raz S, Little NA, Juma S: Female urology. *In* Walsh PC, Retik AB, Stamey TA, Vaughan ED Jr. (eds): Campbell's Urology, 6th ed, vol 3. Philadelphia, WB Saunders, 1992, pp 2782–2827.
6. Staskin DR, Zimmeren PE, Hadley HR, Raz S: The pathophysiology of stress incontinence. Urol Clin North Am 12(2):271, 1985.
7. Siegel AL, Raz S: Surgical treatment of anatomical stress incontinence. Neurourol Urodyn 7:569, 1988.
8. Kjolhede P, Ryden G: Prognostic factors and long-term results of the Burch colposuspension. A retrospective study. Acta Obstet Gynecol Scand 73(8):642, 1994.
9. Reid GC, DeLancey JO, Hopkins MP, et al: Urinary incontinence following radical vulvectomy. Obstet Gynecol 75(5): 852, 1990.
10. Myers RP: Practical pelvic anatomy pertinent to radical retropubic prostatectomy. AUA Update Series, 13(4):25, 1994.
11. Henriksson L, Ulmsten U: A urodynamic evaluation of the effects of abdominal urethrocystopexy and vaginal sling urethroplasty in women with stress incontinence. Am J Obstet Gynecol 113:78, 1978.
12. Delancey JL: Anatomy and embryology of the lower urinary tract. Obstet Gynecol Clin North Am 16:717, 1989.
13. Raz S: Atlas of Transvaginal Surgery. Philadelphia, WB Saunders, 1992, pp 1–23.
14. Young GPH, Wahle GR, Raz S: Modified vaginal wall sling. Presented at the Eighty-Ninth Annual Meeting of the American Urological Association, San Francisco, California, 1994.
15. Klutke C, Golomb J, Barbaric Z, Raz S: The anatomy of stress incontinence: Magnetic resonance imaging of the female bladder neck and urethra. J Urol 143(3):607, 1990.
16. Caine M, Raz S: The role of female hormones in stress incontinence. Communication to the 16th Congress of the International Society of Urology, Amsterdam, 1973.
17. Faber P, Heidenreich J: Treatment of stress incontinence with estrogen in postmenopausal women. Urol Int 32:221, 1977.
18. Smith PCM: Age changes in the female urethra. Br J Urol 44:667, 1972.
19. Tulloch AGS: The vascular contribution to intraurethral pressure. Br J Urol 46:659, 1974.
20. Wahle GR, Young GPH, Raz S: Vaginal surgery for stress urinary incontinence. Urology 43(4):416, 1994.
21. Bavendam TG, Leach GE: Urogynecologic reconstruction. Probl Urol 1(2):295, 1987.
22. Tanagho EA: Colpocystourethropexy. AUA Update Series, 12(27):210, 1993.
23. Wall LL, Norton PA, Delancey JOL: Practical Urogynecology. Baltimore, Williams & Wilkins, 1993.
24. McGuire EJ, Appell RA: Transurethral collagen injection for urinary incontinence. Urology 43(40):416, 1994.
25. Stamey TA, Schaeffer AJ, Condy M: Clinical and roentgenographic evaluation of endoscopic suspension of the vesical neck for urinary incontinence. Surg Gynecol Obstet 140:355, 1975.
26. McGuire EJ, Lytton B, Kollorn EI, Pepe V: The value of urodynamic testing in stress urinary incontinence. J Urol 124:256, 1980.
27. Nitti VW, Raz S: Obstruction following anti-incontinence procedures: Diagnosis and treatment with transvaginal urethrolysis. J Urol 152:93, 1994.